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Editor's Note

Healing and Recovery… Keeping our Eye on the Bouncing Ball

Christopher Hughes, PT, PhD, OCS

I am healing too quickly; please slow the healing process down! When is the last time you heard or have ever heard that statement from a patient?! In reality most of us likely hear, "How come this injury is not healed by now? When can I return to what I like to do? The doctor didn't tell me it would take this long to heal!" Our prognostic ability to define when healing and return to function will occur can often be difficult to pinpoint.

Another interesting situation is when two patients with similar injuries but different healing success get together and talk. All sorts of innuendos and speculations abound. "Why am I not healing as quickly as this other person?" Or an even more interesting scenario is when the same person undergoes arthroplasty for both knees at different times by the same surgeon and experiences a different healing response. To help the patient gain perspective we do our best to explain the variability but sometimes, it is what it is…different!

Trying to predict healing time with any real degree of accuracy can be as challenging as predicting the weather. Usually we can only give estimates based on what we infer from signs, symptoms, and response to care over multiple evaluation periods. Educating the patient about the healing process is important. The consumer often depends on us to decipher through various sources including interpreting what the physician is telling them about recovery and also what is put out by the media on not only how to prevent injury but also what to do once an injury occurs. Separating fact from fiction can be elusive for the patient as well as the therapist.

Each of the 4 articles in this issue attempt to shed light on what works or what factors influence a healing outcome. Clearly how to best treat is on the minds of these authors. So much so that the majority of articles we publish in OP describe the authors' approach to rationalizing an intervention

A thorough understanding of the healing process is essential for efficient rehabilitation. A common model for healing presented in the literature espouses a 3-phase continuum to healing--specifically, the inflammatory response phase, fibroblastic repair phase, and the maturation-remodeling phase.[1] Essential mediators in the healing process form the basis of tissue repair. However so many other factors or co-morbidities can disrupt any 'straight line' progression to success. As clinicians we need to be experts on how healing can be optimized. This is a daunting task in some respects; often filled with myths, misconceptions, and just a plain lack of high quality research. Furthermore, there is a lack of research on how some areas such as nutrition, psychological interventions like hypnosis, and stress management techniques affect healing. Medicine also has had its share of good gone bad. Medications like the previously popular COX-2 inhibitors have been found to have high risk. Surgical techniques such as thermal capsulorrhaphy are not ideal for all patients and may have questionable outcomes.[2-4] Intra-articular pain infusates such as Bupivacaine once thought to be a catalyst to healing have turned out to be less than optimal, causing tissue damage at the expense of mediating pain. Indeed, trying to find the best avenue to successful healing can be a slippery road.

Of course not all innovations have had dire outcomes. The advancement of arthroscopy has had a major impact on how we treat postsurgical patients and speeding recovery. Minimally invasive techniques for joint arthroplasty and artificial disk replacement continue to be scrutinized with promise. In the end, the success of any of these surgical treatments will likely depend on the skill of surgeons and how well they pick their patients in addition to the technology implemented.

The hunger for the field of medicine to keep pushing toward faster healing and more effective interventions will continue as a result of, or even in spite of, the current health care climate. I imagine this will also be the case with the gain in popularity of new treatments like platelet rich plasma and other biologics.[5] In addition, the current battle and debate over the use of stem

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cells will definitely influence just how far researchers can push the envelope. Not accepting the status quo can ultimately force our hand in being accountable. We will also have to look introspectively at what we do and answer the question, Am I a facilitator, inhibitor, or am I a negligible player in the healing process?

As clinicians we need to follow our patients closely to see if these new treatments are responsible for decreasing healing time or if they just play into a placebo effect. Taking part in well controlled studies and providing measureable outcomes will go a long way in deciphering whether future biologics will result in real improvements in healing. After all, the majority of healing takes place on our watch and under our plan of care. The physical therapist is in an ideal position to act as a healing accelerant. As such, we need to take advantage of this time with the patient. The ability to properly diagnose, classify accurately, and then apply the best treatment taking into account healing factors of each patient will give us the best advantage to being a facilitator of the healing process.

As physical therapists we don't have the luxury of picking our patients to stack the deck in our favor. We need to stay up on the current advances in medicine to optimize care for ALL patients. Knowing what hinders and what helps will go a long way in getting people back to function within the current pressures of an ever-changing economic model in health care. My advice is to not only follow the bouncing ball but be ready to catch it!

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President's Corner

James J. Irrgang, PT, PHD, ATC, FAPTA

Usually each fall I talk about the start of the New Year with the beginning of the academic year and the start of football season! However this year, I would like to pose a question to you--"How do you know that you are providing the best possible care for your patient?" To some, the answer to this question is, "I know the treatment that I provide works because I have seen it work for other patients." Others may indicate that they utilize the principles of evidence-based practice to identify the most optimal treatment for an individual patient's condition.

Over the last 10 years, there has been much discussion about the virtues of evidence-based practice. Certainly, all of us can recite the definition of evidence-based practice, which in the words of Sackett is "the conscientious, explicit, and judicious use of the current best available evidence to make decisions about the care of individual patients." The current best evidence is clinically relevant research that is patient-centered and addresses questions related to diagnosis, prognosis, and intervention. Application of the process of evidence-based practice involves developing a clinically relevant question that addresses a gap in knowledge that is necessary for management of a specific patient, systematically searching the literature to identify evidence to answer the question, critically appraising the evidence to assess its validity, impact and applicability, and applying the evidence to manage the patient. Admittedly, this process can be tedious and time consuming and may not always yield a definitive answer for the best way to treat your patient.

To help physical therapists make patient management decisions that are supported by the best available research evidence, the Orthopaedic Section has created evidence-based clinical practice guidelines that are consistent with the International Classification of Functioning, Disability, and Health (ICF). The first guideline on the treatment of plantar fasciitis/heel pain was published in the *Journal of Orthopaedic and Sports Physical Therapy* in April 2008. Subsequently the Orthopaedic Section has published guidelines for the treatment of hip osteoarthritis, neck pain, knee ligament sprains, knee meniscus/articular cartilage lesions, and most recently, Achilles tendinopathy. The clinical guidelines for plantar fasciitis/heel pain, hip osteoarthritis, and neck pain were recently accepted for placement on the Agency for Healthcare Research and Quality National Guidelines Clearinghouse.

The Orthopaedic Section's Clinical Guidelines consider the level of evidence for approaches to patient care that range from Level 1 evidence based on high-quality randomized trials, prospective studies, or diagnostic studies to Level 5 evidence that is based on expert opinion. The overall strength of the evidence for particular recommendations is summarized and graded as A (strong evidence), B (moderate evidence), C (weak evidence), D (conflicting evidence), E (theoretical or foundational evidence), or F (expert opinion). When applying the clinical guidelines, it is suggested that recommendations with higher overall strength of evidence should be integrated into the management of the patient. However there has been confusion in interpreting and applying the guidelines for recommendations that are supported by only weak evidence. A recommendation supported by weak evidence does not necessarily mean that the diagnostic procedure or treatment does not work; it only means that the procedure does not have high level research evidence to support its use. Indeed, the procedure may be effective and could be appropriately used by the physical therapist to manage his or her patient.

Sackett et al make it clear that evidence-based practice is the integration of the best research evidence with your clinical experience and the patient's preferences and values. Thus your prior experience in treating patients with other similar conditions may be used to determine the best approach to manage a specific patient. Furthermore, the patient's preferences and beliefs should be considered when determining the approach to care. For example, based upon a patient's prior experience with physical therapy, she may believe that ultrasound would be beneficial for the treatment of her current episode of low back pain. While there is limited evidence to support the benefits of ultrasound for the treatment of low back pain, there is little harm and cost and the physical therapist may want to consider its use for this patient. However, the physical therapist should also consider use of those interventions that are supported by the research evidence, including the use of manipulation.

A component of evidenced-based practice that is often overlooked is assessment of outcomes and critical performance of your evaluation. This should include an assessment of your adherence to recommended treatment guidelines and the clinical outcomes that you achieve. This requires systematic collection, analysis, and interpretation of information to critically analyze your performance and identify opportunities for improvement. This can be aided by comparison of your outcomes to those of your peers or national benchmarks. The process of outcomes collection and analysis can be aided by use of an outcomes database; however, despite efforts by several vendors to create these databases, their acceptance and use is limited. Often these outcomes databases require a substantial financial investment and they require collection and input of information that are not normally part of routine clinical practice. Additionally the output from these databases is limited and does not readily permit comparison of your results to those of others.

To address this barrier to the assessment of outcomes and critical appraisal of your performance, the Orthopaedic Section is currently working with the American Physical Therapy Association to create a National Orthopaedic Physical Therapy Outcomes Database. It is envisioned that this outcomes database will be provided free to Section members, will make use of a minimum set of standardized outcome measures, and will permit comparison of your results to

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The Relationship of Joint Mobility Index Scores with Physical Activity Level, Musculoskeletal Problems, and Health Practitioner Visits

Kyndall Boyle, PT, PhD, OCS, PRC

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ABSTRACT

Background and Purpose: The relationship between a high degree of joint laxity, ie, generalized joint laxity and various musculoskeletal complaints is unclear and has not been previously investigated with an experimental study sampling patients who seek care from physicians in orthopaedic clinics. The purpose was to investigate the relationship between the degree of joint laxity, using the Beighton Joint Mobility Index, and the frequency of: (1) arthralgias, (2) sprains, (3) dislocations, (4) subluxations, (5) health practitioner visits, and (6) limitations in physical activity level. **Methods:** Forty-six female patients from orthopaedic clinics were assessed using the Beighton Joint Mobility Index (BJMI) and interviewed. **Findings:** Positive correlations were observed between joint mobility index scores and limitations in the 6 dependent variables. All correlation coefficients (r) were statistically significant ($p < .05$) and positive and the magnitudes were low to moderate, ie, .31 - .53. **Clinical Relevance:** Patients with a greater degree of joint laxity reported more limitations in physical activity and a greater frequency of dislocations, subluxations, sprains, arthralgias, and health practitioner visits.

Key Words: generalized joint laxity, hypermobility syndrome, joint assessment, joint extensibility, joint flexibility, arthralgias

INTRODUCTION

Generalized joint laxity (GJL) is defined as excessive joint range of motion in multiple joints using a joint mobility index.[1] The magnitude of GJL has been reported to be greater in females compared to males,[2-7] and decreases slightly with age.[2,7] The degree of joint laxity in females has been reported to be influenced by hormonal variations that occur at birth,[8] throughout the menstrual cycle, and during pregnancy.[9] Female athletes who have GJL tend to have more arthralgias (joint pain) than males.[1,4,10,11] Individuals with GJL and associated musculoskeletal complaints may be labeled as having Hypermobility Syndrome.[12] This syndrome was first described by Kirk et al[12] in 1967 as GJL associated with musculoskeletal complaints in otherwise normal individuals without hereditary disease. The prevalence of Hypermobility Syndrome is 1.7% to 57% depending on the population studied and criteria used for a particular joint mobility index.[13]

Several authors[3,6,10,11,14-18] advocate the use of a joint mobility index to examine for the degree of joint laxity. The most commonly used index is the Beighton Joint Mobility Index (BJMI).[16] Intrarater and interrater reliability of the composite scores of the BJMI (the overall score from 0 to 9) have been reported.[16] The percentage agreement and the Spearman rho for intrarater and interrater reliability of BJMI composite scores were 69% and .86 and 51% and .87, respectively.[16]

The BJMI is scored 0-9, one point being allocated for the criteria being met for 4 tests on both right and left sides of the body and for one test on the spine/hips for a total of 5 tests (Table 1). Higher BJMI scores indicate generalized joint laxity. Literature reports variable criteria to operationally define GJL. In order to consider the individual as having GJL, arbitrary cut-off scores have included BJMI scores between 3-9, 4-9, 5-9, or 7-9. Subsequently, individuals with a BJMI score between 0-2, 0-3, 0-4, or 0-6 would not be considered as having GJL depending on the respective arbitrary cut-off scores.[6,17-19]

It is not known if females seen in orthopaedic clinics who have higher joint mobility index scores (as assessed by the BJMI) are likely to have more musculoskeletal complaints (ie, arthralgias, sprains, dislocations, subluxations), health practitioner visits, and/or more limitation in their physical activity level compared to females who have lower joint mobility index scores. The literature anecdotally suggests a relationship between joint mobility index scores and musculoskeletal complaints, frequency of health practitioner visits, and limitation in physical activity. However, there

Table 1. Beighton Joint Mobility Index (BJMI). One point may be gained for each side for tests 1-4 so that the BJMI score will have a maximum of 9 points if all are positive.

Test	Right Criteria not met = 0 Criteria met = 1	Left Criteria not met = 0 Criteria met = 1
1. Passive hyperextension of the fifth finger to >90°	0 or 1	0 or 1
2. Passive abduction of the thumb to the flexor aspect of the forearm	0 or 1	0 or 1
3. Passive hyperextension of the elbow to >10°	0 or 1	0 or 1
4. Passive hyperextension of the knee to >10°	0 or 1	0 or 1
5. Active flexion of the trunk and hips with knees extended so palms rest on the floor	0 or 1	_____
Sum of tests 1-5	0-5/5	0-4/9
Total composite BJMI score	0-9/9	_____

is no known quantitative research to support a relationship between joint mobility index scores and subluxations, frequency of health practitioner visits, or limited physical activity. Quantitative literature that has investigated the relationship between joint mobility index scores and arthralgias and dislocations is controversial. If there is a relationship between the degree of joint laxity an individual has and their musculoskeletal complaints, frequency of health practitioner visits, and decreased function, then it would be an important explanation for patient education.

The purpose of this study was to investigate the relationship between the degree of joint mobility as measured by the BJMI and frequency of self reported: (1) arthralgias, (2) sprains, (3) dislocations, (4) subluxations, (5) health practitioner visits, and (6) limitation in physical activity. The research hypothesis is that females with higher scores on the BJMI tend to have a higher frequency of arthralgias, sprains, dislocations, subluxations, health practitioner visits, and more limitation in their physical activity.

METHODS

Subjects

Forty-six female patients (15-44 years of age, average age of 28) were recruited from 5 types of orthopaedic clinics at a university hospital: sports medicine, spine, general orthopaedics, hand/wrist, and ankle/foot.

Subjects were asked by the primary investigator if they would be interested in volunteering to participate in the study as they entered the clinic. Data were collected by a licensed physical therapist with 6.5 years experience as a full-time clinician in outpatient musculoskeletal settings and 6.5 years of experience using the BJMI. After agreeing, each patient reviewed and signed an informed consent form that had previously been approved by an appropriate Institutional Review Board. Nine to 10 subjects were recruited from each clinic. Exclusion criteria were determined during an in-person interview conducted by the primary investigator. Individuals with neurological disorders and documented or known connective tissue disease as well as those individuals on worker's compensation, applying for disability, or involved in litigation were excluded from the study. Any patient that did not meet any of the above exclusion criteria was included in the study as a subject.

Procedures

Subjects were assessed with the BJMI[20,21] and then interviewed by the primary investigator. The protocols described by Norkin and White[22] were used by the investigator for goniometric passive range of motion measurements of knee, fifth finger, and elbow extension. The goniometric protocols were used to determine if the BJMI criteria were met, rather than relying on visual observation alone. The interview data obtained consisted of a frequency count of: arthralgias, dislocations, subluxations, sprains, health practitioner visits, and yes or no answers to questions regarding participation in physical activity. Arthralgias caused by trauma not associated with physical activity, including motor vehicle accidents and ganglion cysts, were excluded from data analysis.

During the interview, the principal investigator asked each subject: "Do you currently have or have you had at any time in your past, any mild or severe pain in your: feet, ankles, knees, hips, low back, mid-back, neck, jaw joints, head, shoulders, elbows, wrists, hand/fingers, or thumbs?" This question allowed each subject to answer within a range of 0-24 across joints and joint regions. For example, if a subject reported pain in their right ankle, right and left knees, and left elbow, 4 arthralgias were documented. Additionally, the investigator asked the subjects if they had ever dislocated, partially dislocated, or sprained a joint(s). Frequency of dislocations, subluxations, and sprains were documented for the joint(s) involved. Frequency was documented as the total number of occurrences for arthralgias, sprains, and health practitioner visits. Frequency was documented as a total number of occurrences or as an estimate for ongoing occurrences for dislocations and subluxations by multiplying the frequency (eg, one time per week) by the duration (eg, one year).

The frequency of health practitioner visits was calculated by counting one visit per health practitioner for each joint condition. Physical activity limitation included 3 yes or no questions: (1) "As a result of your joint complaints, have you had to temporarily stop any physical activities because of pain?," (2) "Have you had to permanently stop any physical activities because of pain?," and (3) "Do you feel you have had to limit your frequency and/or duration of participation in physical activities/sports or modify your participation in any way?"

Statistical Analysis

The Statistical Package for the Social Sciences Release 6.0 (SPSS, Inc., Chicago, IL) was used for the correlational analysis. Pearson correlation coefficients were calculated to determine the relationship between the independent variable of BJMI scores (from 0-9) and 6 dependent variables: (1) arthralgias, (2) dislocations, (3) subluxations, (4) sprains, (5) health practitioner visits, and (6) limitation of physical activity. An alpha level < .05 was considered significant. The 3 yes or no answers to the physical activity questions were coded (yes=1, no=0) and then added together to create the limited physical activity variable from 0-3.

RESULTS

All Pearson correlation coefficients (r) and p values between the joint mobility index score and frequency of arthralgias, dislocations, health practitioner visits, sprains, subluxations, and limited physical activity were positive and statistically significant (p = .000 –.035). The magnitudes were low to moderate, ie, .31 - .53 (Table 2). The p values are the probability that the correlation coefficient would occur simply by chance. Scatterplots depicting the relationship between BJMI scores (0-9) and each of the 6 dependent variables are presented in Figures 1-6.

Table 2. Correlation Coefficients and p Values Indicating the Degree of Association between Beighton Joint Mobility Index (BJMI) Scores and 6 Dependent Variables for Patients with Musculoskeletal Pathology (N=46).

Dependent Variables	Correlation coefficient	p value
Arthralgias	.47	.001
Dislocations	.48	.001
Subluxations	.53	.000
Sprains	.31	.035
Interventions (# health practitioner visits)	.39	.008
Limited Physical Activity	.36	.013

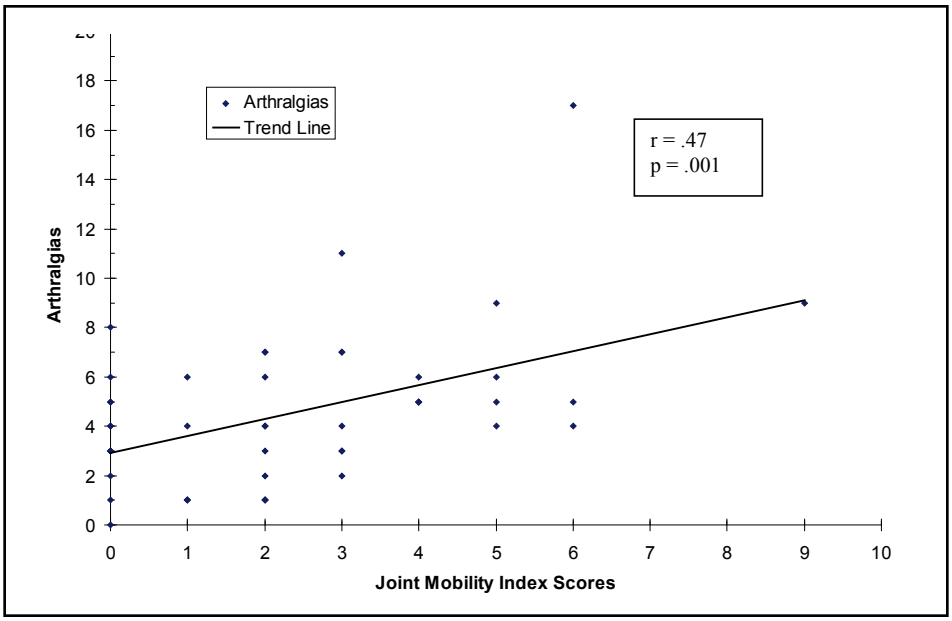

Figure 1. Scatter plot and regression line of mobility scores and number of arthralgias for musculoskeletal subjects. Points may represent more than one case.

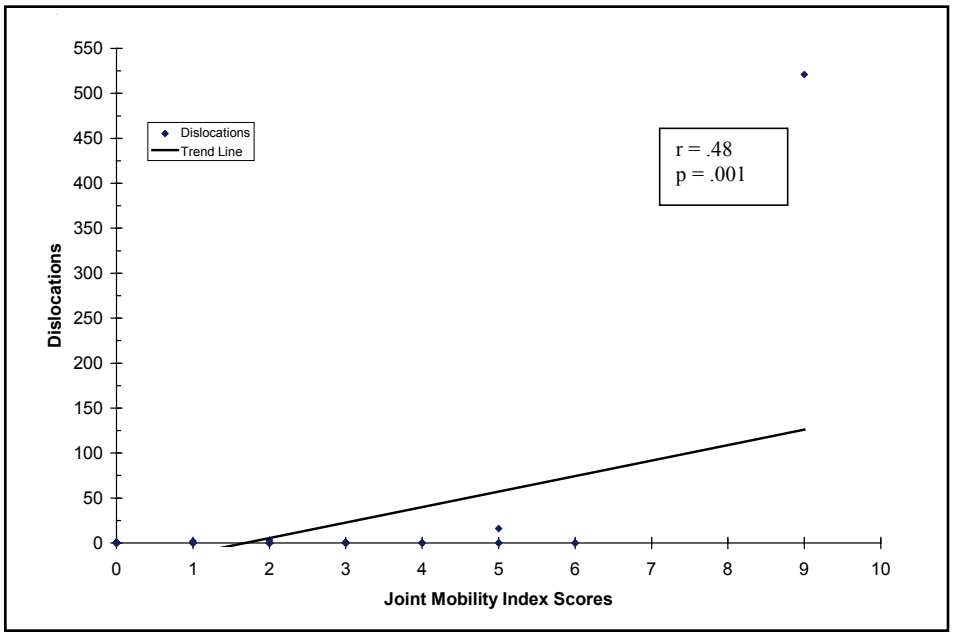

Figure 2. Scatter plot and linear regression line for mobility scores and number of joint dislocations of orthopaedic subjects. Points may represent more than one case.

DISCUSSION

The hypothesis that females with greater BJMI scores would have more musculoskeletal problems (ie, arthralgias, subluxations, dislocations, sprains), visits to health practitioners, and limitation in physical activity was moderately supported by the results of this study. Subluxations, dislocations, and arthralgias were more strongly correlated to BJMI scores than sprains, health practitioner visits, and limited physical activity. A positive relationship between BJMI scores and musculoskeletal complaints, health care visits, and limited physical activity agrees with others who reported either clinical observations or quantitative data[2,4-7,11,12,17,23-28] but disagrees with those who reported no association for arthralgias,[29,30] sprains,[11] and/or dislocations.[17] The discrepancy may be attributed to different joint mobility indices used, different criteria (cut-off points) used to operationally define GJL, and different joint mobility indexes. Not all studies have used the BJMI; some have used the Carter and Wilkinson index[9] or their own unique index.[4,30] Details of literature related to the 6 dependent variables investigated in this study are given below.

Arthralgias

Beighton[20] studied 1,081 people living in a rural village in Africa from 20 to over 65 years, and reported a positive relationship between BJMI scores and arthralgias (correlation coefficient of .96). Gedalia[5] reported that 66% of children (5-17 years old) with Juvenile Episodic Arthritis (JEA) had GJL (operationally defined as BJMI scores between 5-9), concluding that GJL may be an important factor in the cause of JEA. A descriptive report by Howes and Isdale[4] reported findings of 102 patients with back pain from 16 to 70 years. They reported that females who had low back pain without a specific anatomical diagnosis also had GJL (using a unique index including the hands, hips, and spine). The term "The Loose Back" was coined as a result of the study.

A study that did not report a correlation between GJL and arthralgias was done by Jesse et al[30] on 637 healthy volunteers with an average age of 34. They used a modified Carter and Wilkinson index and operationally defined GJL as having scores from 4 to 6 out of 6 possible points, and reported the P value as nonsignificant.

Sprains

Al-Rawi et al[17] reported the prevalence of musculoskeletal complaints for nonathletic university students with GJL (anyone training 4 days/week or more was excluded). They reported more sprains in students with GJL (operationally defined as BJMI scores from 4-9) than in students with BJMI scores from 0-3 ($p < .01$).

In contrast to literature supporting the relationship between GJL and sprains, the previously mentioned study by Jesse et al[30] also reported no statistically significant relationship between sprains and GJL. The results are difficult to compare to other studies where a different index and criteria for GJL was used.

Dislocations/Subluxations

Authors who have described an association between GJL and joint dislocations have noted involvement of the: patella, shoulder, hip, and sternoclavicular joints (SCJs). Subluxations have been implicated for the patella, shoulder, elbow,

wrist,[31] hip,[32] carpometacarpal joint,[33] and the SCJs.[31] These descriptive reports have included a survey of individuals suffering from recurrent dislocations of the patella to other family members with similar complaints.[24] Carter and Wilkinson[8] investigated the incidence of GJL in patients with congenital hip dislocation and in normal school children. Howorth[32] described his clinical observations of pediatric patients with GJL and noted hip subluxations, and patella and shoulder subluxations and dislocations. A descriptive report by Harinstein et al[33] investigated patients with TMJ pain to understand etiologic factors. Their results also included a discussion of their clinical observations of these patients that included shoulder dislocations, and hip subluxations. Lastly, Finsterbush and Pogrund[31] described patients with GJL (using the Carter and Wilkinson index and criteria of ≥ 4-10/10) and their musculoskeletal complaints and noted that 6% had shoulder dislocation, 1% had SCJ subluxations, and 6% had hip dislocation. The study done by Al-Rawi and colleagues[17] mentioned earlier is the only other known quantitative study (other than this study) that looked at dislocations and GJL. When comparing students with BJMI scores of 7-9 versus students with scores of 0-3, dislocations were more frequent but did not achieve statistical significance. The difference between Al-Rawi's results and the current study may be attributed to analyzing the subjects in groups based on BJMI scores (ie, 0-3, 4-6, and 7-9) rather than analyzing each composite score (0-9).

Health Care Visits

Descriptive reports linking GJL with an increase in the frequency of health care visits include the clinical opinions of Lewkonia and Ansell,[34] Hardin,[28] and Kirk et al.[12] Lewkonia and Hardin suggested that failure to recognize GJL in patients may lead to unnecessary investigation or treatments. Kirk believed that recognizing individuals with GJL may decrease medical time. In other words, if laxity was recognized by a health care practitioner and the patient was then educated about the relationship between their complaints and their laxity, it would prevent them from seeking advice from multiple practitioners and having multiple tests ordered to help explain their symptoms. This also would aid in improving treatment recommendations.

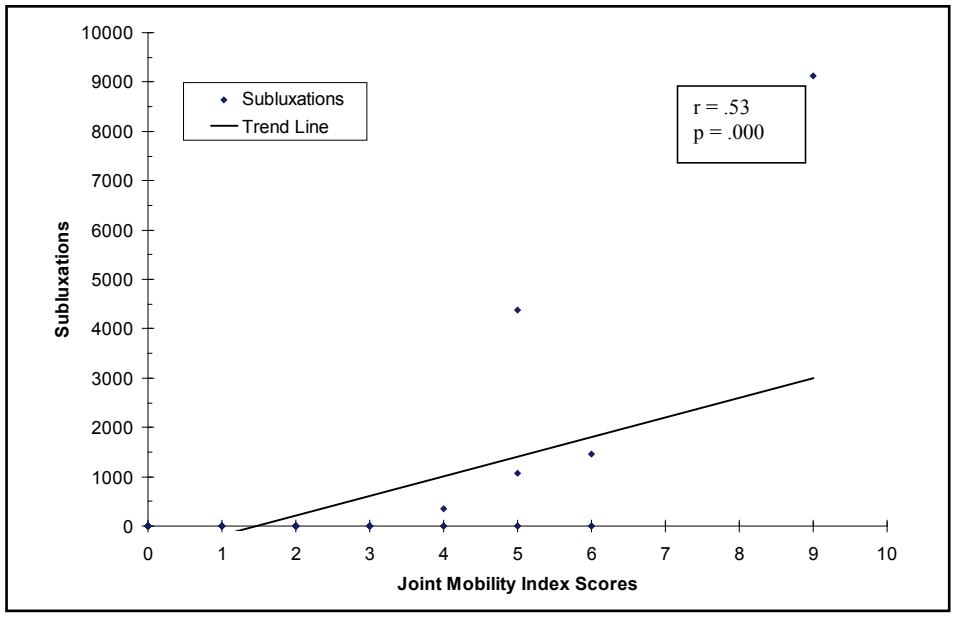

Figure 3. Scatter plot and linear regression line of mobility scores and number of subluxations for musculoskeletal subjects. Points may represent more than one case.

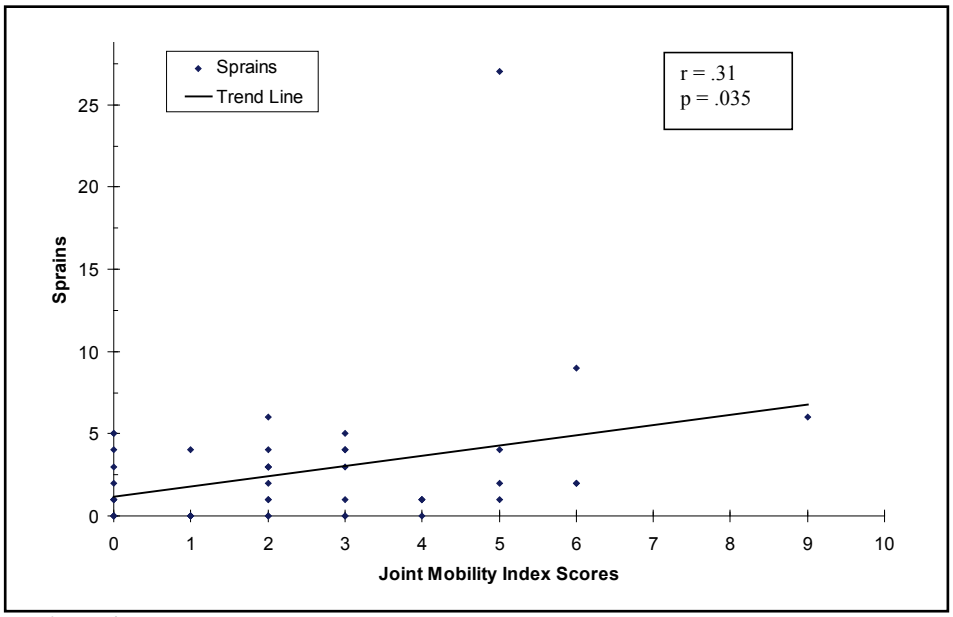

Figure 4. Scatter plot and linear regression line for mobility scores and number of sprains for musculoskeletal subjects. Points may represent more than one case.

Limited Physical Activity

Documented examples of a possible relationship between limited physical activity level and GJL include the inability to participate in contact sports involving running and jumping, limited physical activity in children,[12,35] or the inability to participate in professional ballet dancing.[6,23] Lichtor,[23] for example, stated that hypermobile athletes rarely make it to the professional level because they are often eliminated early as a result of injury or poor performance. Klemp[6] believed that GJL was a disadvantage for individuals wishing to establish a career in dancing.

Study Limitations

Potential limitations and sources of error in the current study include the subject's ability to recall medical history, which may have led to under reporting. Subluxations for example, may have occurred, but the subject may not have been aware of them. Mild sprains may have occurred, but the

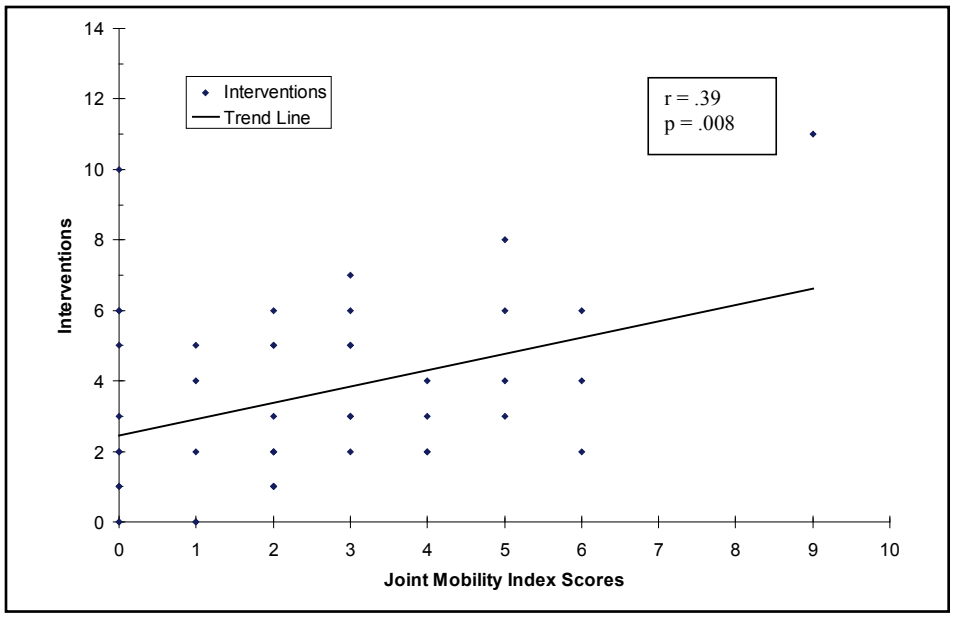

Figure 5. Scatter plot and linear regression line for joint mobility scores and number of interventions (health practitioner visits) for musculoskeletal subjects. Points may represent more than one case.

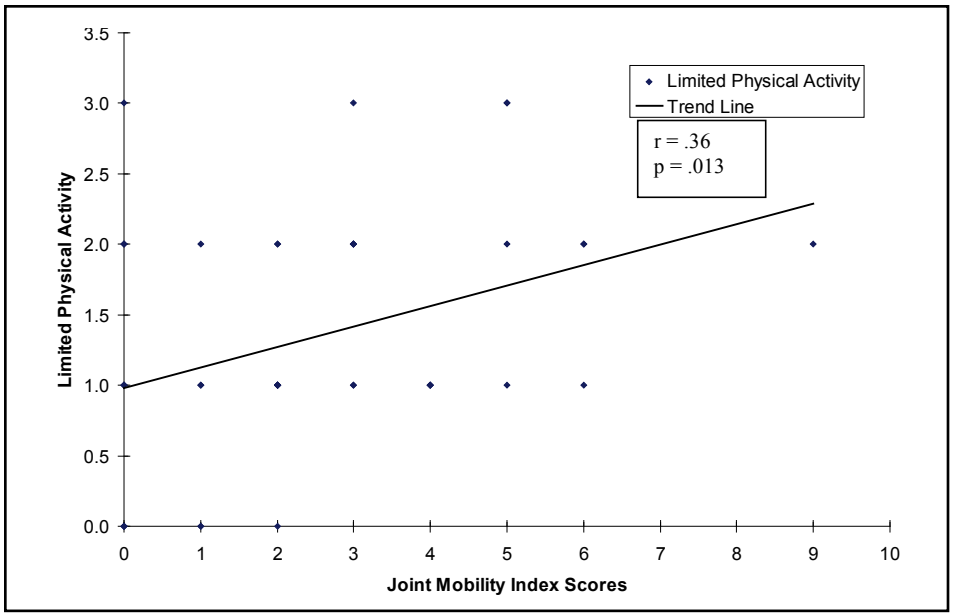

Figure 6. Scatter plot and linear regression line for mobility scores and "limited physical activity" (0-3) for musculoskeletal subjects. Points may represent more than one case.

subject may not have reported those occurrences as sprains. Another source of error may have been the arbitrary nature of the BJMI criteria for when a joint is given a point or not. The arbitrary nature of the index criteria may not truly represent the degree of GJL for those subjects with several joints that were close to the >10° criteria. Subjects who did not meet the criteria but were close to it, for example 9° of hyperextension for elbow, knee, and/or fifth finger tests were considered "not hypermobile," (receiving a score of 0) just as individuals who were further removed from the criteria, for example 0°. This may not have given an accurate representation of the subject, and may have contributed to lower correlation coefficients. In a clinical situation however, clinicians using the BJMI to screen patients may estimate the 5 joint tests and give scores accordingly. The assumption would be that patients having joint mobility very close to the "greater than 10°" criteria would be given a point or points accordingly. Even with possible sources of error, the data in this study suggests a positive correlation between higher BJMI scores and more musculoskeletal complaints.

Recommendations

The results from this study suggest a positive correlation between higher joint mobility scores (as measured by the BJMI) and musculoskeletal complaints, frequency of health care visits, and a greater limitation in physical activity as a result of joint laxity. Athletic trainers and other clinicians can use this information to screen athletes/patients/clients and consider those individuals with higher scores to be at higher risk for more arthralgias, sprains, dislocations/subluxations, health care visits, and greater limitation in physical activity than individuals with lower scores.

Health care practitioners including athletic trainers, orthopaedic surgeons, family practice physicians, physical therapists, chiropractors, dentists, occupational therapists, exercise physiologists, and podiatrists may benefit from using the BJMI as part of their patient examinations to recognize individuals with GJL and then provide patient education and intervention for management of or prevention of musculoskeletal problems. Treatment for athletes/patients with GJL may include education regarding their condition and its association to their complaints as appropriate,[36] education in activity modification,[37-39] stabilization strengthening,[38-40] and proprioception training.[38,39,41-43]

Future research

Outcome studies are needed to determine if intervention for individuals with GJL is beneficial in preventing musculoskeletal complaints, and effective in decreasing functional limitations, disabilities, and medical costs. A qualitative research study to describe the experience of living with GJL may be valuable as well.

CONCLUSION

As the Beighton Joint Mobility Index scores increase, the number of arthralgias, dislocations, subluxations, sprains, and health practitioner visits increase. The limited physical activity variable increases with increasing joint mobility index scores as well. In other words, women with a greater degree of joint laxity (more hypermobile) tend to have more joint sprains, subluxations, and dislocations and tend to seek more health practitioner visits, and their

participation in physical activity is more negatively affected than women with a lower degree of joint laxity (more hypomobile).

ACKNOWLEDGEMENTS

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The Effects of Yoga on Chronic Low Back Pain and Implications for the Physical Therapist

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ABSTRACT

Background and Purpose: Low back pain is among the most common and expensive health condition treated in the United States by health practitioners. The purpose of this paper is to: (1) examine if previous research suggests that yoga does in fact have advantages over traditional exercise and (2) explore the physical therapist's role in using yoga for chronic low back pain patients. **Methods and Findings:** A literature review revealed that there is not substantial published clinical research to make a strong supportive statement regarding the effects of yoga on low back pain. However, findings do suggest that yoga may be just as or more effective than traditional exercise programs at improving function and reducing pain. **Clinical Relevance:** This information has clinical implications for the physical therapist regardless of their level of personal exposure to yoga.

Key Words: exercise, function, disability, intervention

INTRODUCTION

Low back pain (LBP) is among the most common and expensive health condition treated in the United States[1-4] and the most common musculoskeletal condition treated by physical therapists.[5] Thirty eight percent of patients with spine disorders are referred for treatment by a physical therapist.[6] Despite how common the diagnosis is, the condition remains increasingly difficult to define due to its heterogeneity.[2,7] Each patient presents with a unique combination of structural abnormalities including muscular and ligamentous strains, disc abnormalities, and bony malalignments that can all present with similar pain distributions. In addition, studies have shown there is little association between patient symptoms and specific pathological structures viewed in imaging studies.[1,8] As a result, it becomes increasingly difficult to determine optimal interventions for a condition that is heterogeneous and may not be correlated with structural changes. There are numerous nonpharmacologic therapies commonly used to treat low back pain. Interventions cited as minimally or moderately effective in a recent review of evidence by Chou et al[9] for chronic or subacute low back pain include psychological interventions (cognitive-behavioral therapy and progressive relaxation), exercise, interdisciplinary rehabilitation, functional restoration, and spinal manipulation. While it has been recommended that exercise is an effective treatment for chronic low back pain,[9-11] exercise is a vaguely defined in the literature. The ideal form of exercise as well as frequency, duration, and intensity of the exercise has yet to be determined.[11,12] In addition the degree to which exercise is effective in reducing pain or improving function is inconclusive with many studies showing only minimal effects.[9,12] Interventions and length of care for low back pain can vary widely between physical therapists.[5] This reflects the lack of consensus in the literature.

Among the many nonpharmacological interventions available, there is little evidence supporting clinically meaningful and consistent differences between most of the effective interventions. Two potential exceptions include intensive interdisciplinary rehabilitation (interventions provided by multiple health care professionals that combine physical, vocational, and behavioral components) and Viniyoga (a type of yoga customized by the practitioner to the individual). According to Chou et al,[9] these interventions have fair evidence supporting improved outcomes and decreased use of analgesic medications compared to other nonpharmacological interventions.[9]

The purpose of this paper is to: (1) examine if research suggests that yoga has advantages over traditional exercise and (2) explore the physical therapist's role in using yoga for chronic low back pain patients.

YOGA

Yoga is a popular form of exercise and is becoming increasingly commonplace as a form of Complementary Alternative Medicine (CAM) used for a variety of medical conditions. Based on the 2002 National Health Interview Survey (NHIS), 5.1% of US adults aged 18 or over participated in yoga to address health concerns.[14] The majority of the adults surveyed were found to use CAM in general to address back pain/back problems.[14] There are 4 main branches of yoga: Bhakti, Karma, Jnana, and Raja (Table 1).

Hatha Yoga

Hatha yoga is the type of yoga most commonly practiced in the US. The physical poses constitute only 1 out of the 8 branches of this part of yoga. The other 7 branches include: discipline, order; breathing practices; withdrawal of senses; extended concentration; effortless meditation; and complete state of union of mind, body, and spirit. Hatha yoga can be further subdivided into numerous different styles, each one created by a different founding yoga practitioner. The different styles have a unique method to performing poses, all

Table 1. The Four Branches of Yoga[24]

Branches	Definition
Bhakti	"the path of devotion" involves the worship of God in any form whatsoever
Karma	"the path of selfish action" where one performs action without any regard for the results of one's work
Jnana	"the path of knowledge" which involves applying intellect in self-examination and study of scriptures
Raja/Ashtanga	"the path of will-power" This is the 8-limbed branch which includes hatha yoga

Table 2. Types of Hatha Yoga

Type	Practitioner	Description
Iyengar	B.K.S. Iyengar	Makes use of a variety of props so that perfect alignment is obtainable regardless of physical limitations.
Ashtanga	Pattabhi Jois	Makes use of vinyasa or sequences of poses that flow from one to another. Power yoga comes under this style.
Kripalu	Amrit Desai	3 stages: 1. Emphasis on postural alignment and coordination of breath and movement 2. Meditation with postures held for longer times. 3. Practice of postures becomes spontaneous meditation in motion. A gentle form.
Bikram	Bikram Choudhury	26 postures performed in standard sequence in room a heated to 100-110 degrees.
Viniyoga	Gary Kraftsow	A sanskrit term that implies differentiation, adaptation, and appropriate application. This style is customized by the practitioner for each individual.[25]
Anusara	John Friend	Emphasizes postural alignment, coordinating movement with breath, and a positive mental attitude. Slow to moderate pace.[26]

with the same goal of preparing the body and mind for meditation. Table 2 provides a noncomprehensive list of the different types of hatha yoga and its associated yoga practitioner.

EVIDENCED-BASED PRACTICE CONCERNING YOGA

A literature search was performed using OVID MedLine (1950-present), All EMB Reviews [Cochrane DSR, ACP Journal Club, DARE, CCTR, CMR, HTA, and NHSEED], CINAHL [1982-May Week 2 2009]), and PubMed with search terms "yoga" AND "back pain." Six articles were found with relevance to this paper. Of the 6 studies found with the above criteria studying the effects of yoga on chronic low back pain, all used some form of hatha yoga. Table 3 shows study designs used and Table 4 summarizes the results of the 6 studies. This commentary will focus on the 3 randomized controlled trials designed for efficacy analysis for functional outcomes related to chronic low back pain.

Study Designs

Overall, the studies varied widely in their study design, with important differences in their intervention frequency and duration, inclusion and exclusion criteria, and control group intervention.

All of the studies vary widely in design from an 8 hour per day, 7 day long residential program,[15] to 75 minutes per week for 12 weeks.[16] In addition, all practiced different styles of hatha yoga. The disparity in the yoga prescription alone makes results difficult to compare. While the study by Tekur[15] showed significant effects in a short period of time, the residential week long program is quite incompatible with the typical outpatient physical therapy treatment times available in the US. This type of skilled program certainly would not be covered by conventional insurances. Further, the ability to condense this week long program to even one hour would be somewhat impossible, making the applicability of this study to physical therapy limited by the study design alone. Both Williams' and Sherman's study,[16,17] however, are more compatible with typical physical therapy treatment duration and frequency with a design of weekly classes for 12 to 16 weeks.

Inclusion and exclusion criteria also varied in all studies. Only Tekur's study[15] included those with prolapsed disc and/or radiation into the leg. Williams' study[17] was very restrictive, excluding patients commonly seen in physical therapy including those with nerve root compression, disc prolapse, kyphosis, or structural scoliosis. These strict exclusion criteria may in part explain why Williams' study[17] had a less disabled group of patients at baseline in comparison to other low back pain studies. Due to this, Sherman's study,[16] while also excluding sciatica patients, excluded patients with less than 3/10 pain on an 11 point scale to optimize chance to show improvement.

Lastly, control groups varied significantly. Williams[17] had an educational control, Tekur[15] had an exercise control, and Sherman[16] had an educational and exercise control. Tekur's[15] exercise protocol included a general program designed by a physiatrist with flexion and extension based strengthening and stretching components. Sherman's study[16] was more vague in the description of their exercise control. The study stated that aerobic, strengthening, and stretching exercises designed by a physical therapist to be "different from what most participants would have probably experienced in physical therapy sessions." While it is not exactly clear what was done, the program implies general exercise similar to Tekur's study. This approach, while necessary for a class format, eliminates the individualized exercise program implemented in a physical therapy session in which patients are provided a program biased towards their specific impairments.

Outcome Measures

Tekur, Williams, and Sherman[15-17] all examined low back related functional status and pain level, although they all used different assessment tools. Refer to Table 3 for results and below for a comparison of Tekur's, Williams', and Sherman's results as they relate to functional disability and pain.

Outcomes: functional disability. Tekur, Williams, and Sherman[15-17] all found a statistically significant improvement in function with yoga intervention immediately after the intervention or weeks after the yoga intervention ended. Tekur found yoga superior to an exercise group control, while Williams and Sherman found the same in comparison to an educational control group. The comparison to an educational control group, however, must be highlighted as exercise has been shown to have a similar effect size when compared to no treatment.[10]

All three studies[15-17] used different standardized measures to assess functional disability. These measures included the pain disability index (PDI), the modified Oswestry Disability Index (ODI), and The Modified 24-point Roland Disability Scale (RDS). In order to best evaluate the study results, the differences and similarities of these tools needs to be closely examined. A systematic review by Wind et al[18] evaluated all three of the above measures and several

Table 3. Study Designs of Yoga Literature

	Methods	Participants	Interventions	Control
Galantino 2004	Pilot, RCT, wait list control, not powered for efficacy analysis	n=22 >6 months low back pain	1 hour biweekly classes, 6 weeks, Hatha yoga	no treatment
Jacobs 2004	Pilot, RCT, wait list control, not designed for efficacy analysis	n=52 with >6 months low back pain	90 minute, biweekly classes, 12 weeks, Iyengar yoga	education group
Groessl 2008	Pre-post study design	33 Veterans Administration (VA) patients with >6 months low back pain	weekly classes, 10 weeks, Anusara yoga	no control
Tekur 2008	RCT	n=80 with >3 months low back pain	8 hour/day, 7 day long residential program, Integrated approach to yoga therapy taken from traditional yoga scriptures	residential exercise group
Williams 2005	RCT	n=60, >3 months of low back pain	90 min/week, 16 weeks	education group
Sherman 2005	RCT	n=101 with >3 months low back pain	75 min/week, 12 weeks; Viniyoga	1 exercise and 1 education group

Abbreviations: RCT, randomized controlled trial

Table 4. Results Summary of Yoga Literature

	Outcomes: Tools	Outcomes: Pain	Outcomes: Function
Galantino 2004	Pain: Not directly assessed Function: ODI	not directly assessed	no statistically significant difference between groups, but trends suggested a potential for improvement
Jacobs 2004	Pain: Visual analogue pain score, pain medication usage	results not published	results not published
Groessl 2008	Pain: Visual numeric scale (0-10), five-question severity scale Function: not directly assessed	Statistically significant improvement in pain level (t=-4.27, p<0.001)	not directly assessed
Tekur 2008	Pain: subgroup analysis of section 1 of ODI Function: ODI	Significant reduction in pain with yoga (<0.001) and nonsignificant reduction with control. Significant difference between groups (p<0.001).	Yoga had significantly less disability after intervention (p=0.001, ES 1.264) 1.264) and control had nonsignificant reduction in ODI scores (p=0.19). Significant difference between groups (p<0.001).
Williams 2005	Pain: VAS, pain medication usage Function: PDI	Significantly less pain with yoga at 3 months (p<0.05, ES=0.5); Medication usage immediately following (p=0.002) and 3 months after study completion (p=0.004) significantly less with yoga.	Functional disability significantly lower in yoga group immediately after and 3-months after intervention (p<0.01, ES = 2.6)
Sherman 2005	Pain: 11 point scale, pain medication usage Function: RDS	Yoga had statistically and clinically significant reductions in symptoms compared to education at 6 and 26 weeks (p<0.002) and statistically significant reduction in symptoms at 26 weeks compared to exercise (p=0.018); medication usage decreased most sharply with yoga at 26 weeks (p value not reported)	Decreased disability greatest in yoga, then exercise and least with education over course of study; only statistically significant and clinically important difference was between education and yoga at 6, 12 and 26 weeks (p<0.001).

Abbreviations: ODI, Oswestry Disability Index; RDS, Roland-Morris Back Disability Index; PDI, Pain Disability Index

others. The systematic review examined the reliability and validity of these functional scales (and 10 others) to evaluate function in the musculoskeletal system in general. Of the 13 questionnaires assessed for the above criteria, only 4 were found to have high levels of both reliability and validity: the PDI, ODI, RDS, and the Upper Extremity Functional Scale. While this study did not examine the relationship of these measures to low back pain specifically, the systematic review concluded that the three measures were equally reliable and valid in their ability to evaluate general musculoskeletal function.

In contrast, another study by Davidson et al[19] came to a different conclusion. This study examined the ODI and RDS as related to low back pain and found the ODI to be the most reliable with sufficient width of scale to reliably detect change in status, while the RDS lacked sufficient reliability and scale width for clinical application. The RDS is the only tool that asks for dichotomous responses. The ODI and PDI use a 5 or 11 point scale respectively, which increases sensitivity to change. Further, the instructions for the RDS emphasizes for the patient to answer the questions with how they feel today. These instructions might result in responses that are not representative of how the patient feels overall, as the patient may have a very different level of pain in that moment than overall in their daily activities.

The above information calls into question the use of the RDS in Sherman's study. Results revealed that disability was lowest after yoga intervention, higher after exercise intervention, and highest after use of the self care book. However, the only statistically and clinically significant difference presented was between the yoga and educational control group. It must be considered that a tool with a higher sensitivity to change, such as the ODI or PDI, could have a higher probability of discovering clinically and statistically significant changes in function due to the width of the scale.

Overall, there is not enough research to make a strong clinical statement, but what has been published does support the positive effects yoga has in improving overall function in the chronic low back pain population and warrants further study.

Outcomes: pain. There were also differences in how pain was analyzed by Tekur, Williams, and Sherman.[15-17] All studies measured pain with a scale, either a standard 10 cm visual analogue scale (VAS) or numerical 6 point or 11 point scale. Overall, all studies found statistically significant reduction in pain with the yoga intervention irrespective of the scale width used to analyze pain.

Williams' study[17] used the VAS to analyze pain and found a statistically significant decrease in pain intensity 3 months after yoga intervention. There was a 70% decrease in pain reported by the yoga group in comparison to a 38% reduction in pain reported by the control group. Tekur[15] reported similar findings using a 6 point scale with the important difference of an exercise based control group. Lastly, Sherman's study,[16] with an 11 point scale, demonstrated that decreased pain was most pronounced after yoga, then exercise, and least in the education intervention. The only difference that was statistically significant and clinically important was between the yoga group and the education group ($p < 0.001$). While not statistically significant, it is interesting that only the yoga group continued to have reduced symptoms at week 12 and 26, while the exercise and book group experienced worsening symptoms. The study did not continue beyond 26 weeks to evaluate if this trend continued and/or became statistically significant.

Tekur did not study pain medication usage, but both William and Sherman tracked this information throughout their study. Williams reported 88% of subjects in the yoga group decreased or stopped their medication compared to 35% in the control group at the conclusion of the study. This trend continued at the 3 month follow up. Sherman also found a decrease in medication usage in the yoga group. Medication use was 21% of the yoga group compared to 50% in the exercise group and 59% in the book group at 25 weeks after the intervention. Thus, in addition to finding reduction in pain levels with yoga intervention, there was also a finding of decreased pain medication usage with yoga compared to both exercise and educational intervention.

Typically in treating patients with chronic pain, the practitioners' goals are to optimize function and control pain, but not necessarily to eliminate the pain. While effect sizes were not reported with regards to pain outcomes in both Tekur's and Sherman's study, Williams reported only medium effect size (0.5) for pain reduction. The effect sizes for outcomes on functional ability were much higher in William's study. This is, however, consistent with goals typically made for a chronic pain population. A health care professional would like to minimize the amount of pain; however, the focus for the patient is to learn how to manage pain while maintaining the ability to perform activities of daily living.

There is not substantial clinical research to make a strong clinical statement regarding the effects of yoga on low back pain. The current published literature is supportive of the positive effects yoga can have on improving pain levels, improving function, and decreasing medication usage in the chronic low back pain population. It remains unclear, however, if it is superior to other treatments.

Recommendations

Overall the research concerning yoga and chronic low back pain is sparse. All of the studies had a limited follow up longitudinally, with Tekur and Williams using a wait list control design, eliminating the option of long term follow up. The minimal research that has been published, however, does support the hypothesis that yoga may be just as effective as traditional exercise programs. Further research is needed.

Recommendations to improve the study designs of future investigations would include: (1) using the ODI or PDI for a functional scale due to their scale width and ability to detect change, (2) structuring studies with intervention frequency and duration that is reproducible under the current US health care system such as a 60 minute class each week for 12 weeks, (3) longer follow-up periods for evaluation of any long term benefit of yoga on functional ability and pain.

APPLICATION TO CLINICAL PRACTICE

Exercise intervention alone for chronic low back pain has been shown to be minimally effective in reducing pain or improving function.[9,12] While more research is needed, the published data regarding yoga and chronic low back pain discussed above suggests that yoga may be as effective as an exercise intervention in the chronic low back pain population for improving function and reducing pain.

The focus on overall well being and mental state highlights some of the important differences between yoga and a more traditional exercise regime. Regardless of the type of yoga practiced, its foundation includes breathing, relaxation, and focus

techniques. Thus, yoga becomes a combination of both exercise and psychological intervention.[9] In addition, the exercise portion itself may have unique characteristics separate from traditional exercise. For example, the sequencing of poses or the longer duration for which poses are maintained in many types of hatha yoga may have different effects on pain, function, or tissue physiology that is not yet fully understood.

Chronic low back pain is a multifactorial condition that is poorly understood. Pathophysiological models concerning chronic low back pain are preliminary, but do support a psychological component. Patients develop a fear of movement, depression, and other emotional distress surrounding their chronic pain.[20] Further, it is hypothesized that the chronic pain cycle can result in central processing abnormalities at multiple levels of the nervous system.[20] This has important implications for the potential mechanisms of action surrounding yoga and chronic low back pain.

Potential mechanisms suggested for yoga's possible clinical benefit include the combination of physical body alignment and posture, relaxation response, and psycho-emotional equilibrium.[21] More specifically, one study by Stretter et al[22] examined the brain gamma-aminobutyric acid (GABA) level changes as a result of yoga practice. Gamma-aminobutyric acid is a neurotransmitter in the brain linked with depression and anxiety when present in insufficient amounts. Traditionally deficits in GABA are treated with medications that upregulate GABA. This study, while only having a modest sample size, found statistically significant upregulation of GABA after an hour yoga session in experienced practitioners. This study provides a plausible explanation for one of the mechanisms of action for improved pain and functional levels after yoga intervention. More research is needed.

Yoga Certification

While there is no state or federal guidelines for yoga certification, typically certification requires either a 200 hour or 500 hour course with the Yoga Alliance governing registration of schools and instructors to insure health and safety standards and quality of instruction (http://www.yogaalliance.org/teacher_search.cfm, accessed 8/31/09). A yoga school or instructor does not have to be a part of this organization to be a certified yoga instructor (CYT), but does need to be part of this organization to be a registered yoga instructor (RYT). Class content includes education on technique training and practice, teaching methodology, anatomy and physiology, yoga philosophy and lifestyle, and practicum. Yoga education and formal physical therapy education overlap to some degree in regards to anatomy and physiology and technique training for commonly used poses. However, yoga education largely encompasses material that is not part of physical therapy's educational standards, such as education in meditation and chanting and energy anatomy and physiology, such as chakras.

As physical therapists, our role in yoga intervention has not been thoroughly explored. Some physical therapists have already begun to implement yoga into their practices. Physical therapists both with and without yoga certifications have discussed their role in implementing yoga in patient care in an April 2008 issue of *Physical Therapy* magazine.[23] One therapist discussed the evolution of her evaluations once receiving her yoga certification to include not only traditional evaluation components, but additional questions regarding a patient's emotional state, sleeping patterns, and digestion quality. While she states that she is not treating the depression or anxieties per say, she will use breathing techniques to help patients in these areas.[23]

Some may argue a physical therapist that regularly practices yoga has the skills needed to incorporate yoga into their treatment plans. As experts in movement, we could incorporate individual yoga poses safely into treatment plans; however, it could be argued that performing one yoga pose in isolation is quite different from an entire session. This is due to the ordering and flow of poses and the focus on the mind-body connection that physical therapists have less experience in. An interesting aspect of Tekur's study design included the specific exercises for the exercise control group that included yoga postures such as double knee to chest and cat/camel. This supports the need to further investigate the differences between yoga postures in isolation as opposed to a complete practice.

It is of key importance, regardless of formal training in yoga or physical therapy, that yoga is done correctly as yoga students are often asked to use strength in extreme ranges of motion. If poses are performed incorrectly, students can easily injure themselves. This is why Sherman suggests finding an instructor who has experience working with back pain individuals when seeking out yoga for chronic low back pain. A physical therapist trained in yoga would fit this description perfectly as he would have the mind body focus as well as detailed knowledge on proper form for yoga poses.

To a physical therapist without yoga certification, this research still has clinical implications. It provides the typical physical therapist with a basis for discussion regarding questions patients may have regarding yoga intervention or as a suggestion for patients when traditional exercise does not appear to be addressing their needs. If poses in isolation seem to be effective for the patient, referral to a physical therapy colleague with a certification in yoga or a yoga certified and registered instructor could be very beneficial. If a physical therapist does not personally know someone to refer a patient to, there are other options. The yoga alliance has a comprehensive Web site (http://www.yogaalliance.org/teacher_search.cfm) that has a searchable database of yoga certified instructors by name, state, and teaching level. By referring the patient to this Web site, the physical therapist can know that the instructor has completed a specified and regulated educational program.

SUMMARY

Chronic low back pain is an extremely common condition lacking a clearly effective intervention. Yoga, while an ancient practice that is very common in the United States, has just recently been investigated in the literature as a possible treatment for chronic low back pain. In this commentary, we have attempted to provide information regarding the published literature surrounding this topic and its application for the individual with chronic LBP.

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An Evidence-based Approach to the Orthopaedic Physical Therapy: Management of Functional Running Injuries

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ABSTRACT

Background and Purpose: Running is a functional activity of daily living for many individuals. Running is not simply for sports participants or the marathon runner. Along with recreational activities, many run for work requirements, educational standards, and achievement of developmental motor skills. The purpose of this article is to define running as a functional activity of daily living, identify risk factors for common running injuries, and propose an evidenced-based model supporting the orthopaedic physical therapy rehabilitation of running injuries. **Methods:** An effective approach for treating nontraumatic running injuries was developed by conducting a thorough review of the literature in conjunction with independent clinical experience. **Findings:** Understanding proper staging of patients running injury and its accompanying stage-specific rehabilitation can improve functional outcomes. **Clinical Relevance:** Physical therapists are experts in the treatment of musculoskeletal injuries, and it is important to identify, evaluate, and treat running injuries with the goal of return to functional running.

Key Words: running injury management, orthopaedic physical therapy, functional running injuries

INTRODUCTION

Running is more dynamic, demands greater weight bearing, and stresses soft tissues more than walking; therefore, the chance for injury is greater with running. These injuries are most often nontraumatic and musculoskeletal in nature. It is a common misconception that running injuries occur in only the athlete who participates in races or sport. In reality, the ability to run is actually a functional activity of daily living for many noncompetitive individuals. There are an estimated 4.1 million runners in the United States; this is a 30% increase since 2000. Of these, 69% do not participate in races.[1] These 2.8 million people do not run simply to participate in running, they run because it is a necessity; it is a functional part of their lives. For many, the ability to run has a direct impact on their capability to perform their jobs, participate in required physical education class, and maintain health. Hence, running is a required functional activity of their daily living (ADL).

The various branches of the United States military each have a specific physical abilities test that includes minimal running distance and time requirements for initial enrollment, maintenance, and promotion. The army holds soldiers to specific standards in which they are continuously tested. These standards ensure that soldiers are physically able and prepared for the demands of combat. One critical component of the Army Physical Fitness Test (APFT) requires a 2-mile run. Soldiers are consistently tested for their ability to complete this run in a timely manner based on gender and age standards. Army training guides also outline expectations for sprint and running agility.[2,3] Furthermore, promotion into special operations, such as Green Beret or Army Ranger, requires advanced running speed and agility.

All other branches of the military hold similar running standards for entrance, maintenance, and promotion. The United States Air Force requires members to complete 1.5 miles and the Marines run a minimum of 3 miles.[4,5] The military uses these standards to ensure cardio respiratory endurance and the endurance of the lower extremity muscles. The ability to perform at the required running standards is a means to prepare soldiers for the life and death situations they may face in combat.

However, military personnel are not the only professionals required to run. Police officers, fire fighters, paramedics, and lifeguards are only a few professions where one's ability to run could mean the difference between life and death. States vary on the required running distance, but many states have adopted the Police Officers Physical Abilities Test (POPAT). Every police precinct has a specific abilities test, and officers are required to run anywhere from a 300 meter sprint up to 1.5 miles.

Adults are not the only patients we may see with goals to return to functional running. Standardized developmental charts define running as a motor skill acquired between 2 to 3 years of age.[6,7] The mastery of motor milestones are critical in a child's ability to progress through motor development and build on mastered skills. Running is a critical component of this progression. Furthermore, as these children age, their ability to run substantially affects their ability to participate in physical education class at school. Not only do these children need to run in order to participate in organized sports such as soccer, football, volleyball, and baseball, but many physical education programs have adopted the Presidential Fitness Challenge that encourages health and physical fitness. Every student is tested, and timely completion of a 1 mile run is required in order to meet the challenge.[8] The goal of the Presidential Fitness Challenge or any running requirement is to develop and assess physical fitness with a functional physical activity.

EVALUATION AND TREATMENT OF RUNNING INJURIES

With dynamic physical activity, such as running, there is a chance for musculoskeletal injury. Studies estimate ranges of 20% to 80% of runners incur at least one injury each year.[9,10] Although risk for running injuries is multifactoral, several specific risk factors have been identified. Training errors, the number of miles run each week, and inexperience are extrinsic risk factors. Specifically, inadequate running equipment, less than 3 years of running experience, and improperly increasing frequency, velocity, and duration of running is associated with the highest risk for injury. Intrinsic factors

associated with injury include muscular flexibility and strength imbalances, prior injury, and positional/postural malalignment.[11,12]

There are over 20 different running injuries with 70% to 80% of injuries occurring from the knee and below. Patellofemoral pain syndrome, shin splints, Achilles tendonitis, stress fractures, plantar fasciitis, iliotibial band syndrome, patellar tendonitis, and ankle sprain are among the most common injuries.[13]

Treatment of specific injuries should focus on the patient's individual impairments, movement dysfunctions, and the efficient return to running as the ultimate functional goal. Impairments associated with musculoskeletal running injuries include: pain, edema, inflammation, muscle strength and mobility imbalances, altered timing of muscle firing, muscle fatigue, muscle weakness, ligament and tendon impairments, impaired joint range of motion (ROM), and biomechanics. These impairments alter neuromuscular control, proprioception, and present with associated movement dysfunction.[14,15] Hence, running performance is affected.

Initial treatment of running injuries begins with determining the severity of the injury in order to clinically stage at what point to begin the patient's rehabilitation. A proposed system for staging running injuries is outlined below.

- Stage 1: Pain upon exertion
- Stage 2: Pain at rest
- Stage 3: Pain that interferes with ADLs
- Stage 4: Pain that is managed with medication
- Stage 5: Pain that is crippling

Staging running injuries provides insight into the severity of a particular injury and general prognosis. As injuries present in more advanced stages, the time spent in the early phases of rehabilitation is likely to be longer. For example, a patient who is unable to walk normally with severe edema concurrent with a Stage 5 injury that has worsened over the course of 4 months, will likely spend a fair amount of time in the initial edema and mobility management phase of rehabilitation. The same is true for less severe injuries. If a patient presents with a Stage 1 injury, with no associated edema or mobility impairments, then they will spend little time, if any, in the first phase of rehabilitation. However, staging running injuries should only be a guide, initial placement and advancement into the phases of rehabilitation is specific to each individual and based on the physical therapist's evaluation and continuous assessment.

One recent case we treated involved a police officer who came into the clinic with Achilles tendonitis. Symptoms began soon after he began improperly training for the running portion of his police officer physical fitness test. He was extremely concerned because his job depended upon his ability to pass this test. His symptoms began approximately two weeks before seeking treatment, and the pain was exacerbated by running and remained for a short time after he stopped. He assured us that he had not taken any medication for this injury; thus, he presented with a stage two injury.

The next step of the evaluation is to identify compensations and dysfunctional movement patterns during either active walking or running, dependent upon the individual's ability. These dysfunctions vary based on the stage of injury, mechanism of injury, and individual differences. Bobath originally proposed a problem-solving approach to the assessment and treatment of individuals with disturbances of function, movement, and postural control.[16-18] Using an individualized reasoning process, the concept provides a way of observing, analyzing, and interpreting task performance.[18] Concepts described by Bobath in the treatment of gait dysfunction apply to patients with nontraumatic running injuries presenting with neuromuscular impairments.

The final step is the manual evaluation of mobility, strength, and neuromuscular impairments. Manual therapy used in conjunction with neuromuscular re-education, therapeutic exercise, and therapeutic activities should be used to address joint and tissue specific impairments throughout the phases of rehabilitation. Manual therapy is the clinical approach using skilled, specific hands-on techniques used by the physical therapist to evaluate and treat soft tissues and joint structures for the purpose of modulating pain; increasing ROM; reducing or eliminating soft tissue inflammation; inducing relaxation; improving contractile and noncontractile tissue repair, extensibility, and/or stability; facilitating movement; and improving function.[14,19] Manual therapy, proprioceptive neuromuscular facilitation, and neurodevelopmental treatment should be incorporated appropriately depending on the individual's learning style and current standing within the proposed phases of running rehabilitation.

PHASES OF REHABILITATION[20]

Phase One: Self Management, Rest, Restore ROM

This acute stage includes temporary relative rest from running to prevent further damage. PRICE (protection, recovery, ice, compression, and elevation) is implemented and full range of motion of the injured structure is regained. Since the inflammatory response occurs only in the acute stage, modalities should only be implemented during the initial stage of rehabilitation. After the acute phase of injury, there is no significant effect in terms of function, swelling, or pain at rest. However, manual techniques are appropriate throughout the course of rehabilitation to regain and maintain mobility as needed.

Manual mobilization to increase soft tissue and joint mobility has played a significant role in physical therapy practice since practitioners such as Menell and Cyriax described it in the early 1900s.[21] Currently, numerous studies demonstrate that manual therapy is an effective intervention for diagnoses associated with a running injury, and several studies conclude that manual therapy is far more effective than the use of passive modalities.[22-24] Cleland et al demonstrated that patients treated with manual therapy paired with therapeutic exercise had significantly better outcomes in plantar heel pain and function than those treated with a combination of ultrasound, iontophoresis, crynotherapy, and exercise.[22] Crossley et al demonstrated that manual therapy was significantly favored in the treatment of patellofemoral pain syndrome versus a placebo.[23] Multiple studies have demonstrated that intervention including manual therapy improve ROM, swelling, and pain in patient's with ankle sprains versus control groups or those receiving passive modalities.[24]

Our patient presented with mild posterior ankle edema and limited dorsiflexion range. Therefore, our initial treatment included manual mobilization and education/demonstration of self edema management techniques.

Phase Two: Fix Muscle Imbalance and Work on Body Awareness

Musculoskeletal running injuries often result as a partial or complete destruction of the joint and/or ligament receptors.[25] It is also likely that the joint receptors that remain intact relay altered afferent information.[25] Both physiological changes, the loss

of information from mechanoreceptors, and the induced changes of remaining receptor inputs, are considered to be responsible for functional deficits such as poor postural control, delayed muscle reaction time, and muscular imbalances.[25] A muscle imbalance is related to tightening of a mobilizing muscle and a weakening of a stabilizing muscle.[26] Mobilizing muscles are those that produce movement. They are often big muscle groups that produce high power. In contrast, stabilizer muscles are often smaller and control movement or joint position, working against gravity. Muscle imbalances contribute to postural instability and can lead to inappropriate biomechanical alignment and compensatory mechanisms. Thus, with the aim of improving and optimizing postural orientation, rehabilitation during phase two focuses on the restoration and enhancement of proprioceptive and neuromuscular stabilization. Activities focus on balance, positioning, and posture with emphasis to improve the areas that are distressed during running. For example, our police officer presented with 90° straight leg raise with a dorsiflexed foot on the unaffected extremity and 45° on the affected extremity. To address the inflexibility in the hamstrings, gastrocnemius, and soleus we had the patient perform supine active knee extensions with the hip flexed to 90° and the foot in dorsiflexion. Emphasis was place on hip, knee, and subtalar neutral alignment while the active stretch was performed. Next, this same alignment was again emphasized with a balance activity. He maintained a single leg stance with hip, knee, ankle, and foot in a stable, neutral position while performing the dynamic arm swing associated with running.

Visual, verbal, and manual tactile feedback is used to aid the runner through the stages of learning and skill acquisition during postural and stability exercises. Initially, as the runner is in the cognitive stage of new skill acquisition, feedback is high. As the runner progresses through the associative stage when the basic fundamentals of the task are established, feedback should be adjusted accordingly to further challenge the runner and allow them to self correct. Finally, the runner should achieve a sense of autonomy with the postural and stability tasks and move on to phase three.

Phase Three: Functional Strengthening

This phase continues to build upon therapeutic exercise and incorporates activities that emulate the crucial components of running that are impaired. After developing postural control in phase two, phase three progresses with more challenging functional tasks to build strength. Postural orientation for task performance requires the interplay between stability and mobility. Muscle activation patterns are determined not only by postural alignment over the base of support in respect to gravity but also by the interplay between closed and open chain movements.[27]

Because of the relative position of the body during weight bearing activity, closed kinetic chained exercises allow a functional pattern of movement. It provides multiplanar isometric, concentric, and eccentric contractions. Closed kinetic chain rehabilitation has been shown to decrease shear forces, increase proprioception, and increase muscle group coordination.[28] Blackburn et al demonstrated that closed kinetic chain strength is positively correlated with functional performance and no relationship exists between open kinetic chain strength and function.[28] A significant feature of closed kinetic chain rehabilitation is the optimal development of proprioception.

Rehabilitation should focus on re-educating proprioceptors to recreate functional movements in running/athletic performance. Closed kinetic chain exercises are economical, efficient, and an effective means of rehabilitation to achieve the goal of enhancing proprioception, thus gaining lower extremity joint stability.[28] Developing proprioception and incorporating intrinsic timing with muscle force are essential for accurately performed functional activity.

Once in Phase Three, our patient performed functional strengthening by stepping up and over a large step in one movement. Verbal and tactile feedback is given for foot placement, hip and knee alignment, and velocity of movement. This closed chain functional stepping exercise enhances proprioception and strengthens the hip, knee, and ankle musculature required for forward propulsion.

Phase Four: Efficient Return to Running (functional goal is running)

The final phase of running rehabilitation pulls together the skills acquired in the previous phases in order to return to efficient running. Goals of this final phase include: building endurance, power, and running efficiency.

Endurance running is associated with eccentric muscle fatigue, particularly the hamstrings, and eccentric muscle fatigue may be a potential risk factor for knee and soft tissue injuries during running.[29] Therefore, eccentric muscle training should be introduced as an integral part of the training program for runners. Plyometric exercises are implemented to build eccentric strength and develop muscle power. Plyometric exercises are high intensity training techniques that incorporate explosive eccentric-concentric muscle shortening to produce a large force.[29] The most common plyometric exercises include hops, jumps, and bounding movements. Numerous studies have demonstrated that plyometric exercise assists in increasing the reactivity of the nervous system and improving the efficiency, endurance, and power in running muscles.[29,30]

Along with plyometric training, the runner should be engaged in running during phase four. Treadmill training using visual cueing from a mirror and verbal/tactile cueing from the therapist provide the best feedback during the cognitive stage. As the runner progresses into the associative and autonomous stages, less feedback is given and the patient may begin a safe run/walk program progressing to achieving independent functional running and discharge from physical therapy. Our patient initially began his return to running with a ratio of 4 minutes walking to one minute running for a duration of 60 minutes. As he successfully completed this task several times each week, we progressively decreased the amount of walk time concurrent with an increase in time spent running until our patient was able to run continuously.

CONCLUSION

Running is a critical requirement for participation of many activities not only competitive athletics; therefore, it is the therapist's responsibility to focus on the restoration of the ability to independently and efficiently perform this ADL. By properly staging his running injury and implementing associated stage-specific rehabilitation, we were able to help our patient pass the running portion of his test and return to his work duties. Because most running injuries are musculoskeletal in nature, orthopaedic physical therapists must be proficient in staging the injury, identifying the impairments, and implementing an effective intervention program in order to optimally return our patients to participation in functional running.

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PRESIDENT'S CORNER

(continued from page 195)

those of your peers. Development of the outcomes database will be consistent with the clinical practice guidelines that have been developed by the Section, which is expected to promote utilization and implementation of the practice guidelines. Individuals that input data into the National Orthopaedic Physical Therapy Outcomes Database will be able to obtain standard reports that will allow the individual to compare his or her performance to those of other physical therapists and to the recommended clinical practice guidelines. Use of the National Orthopaedic Physical Therapy Outcomes Database will allow individuals to critically analyze their performance with the intent of identifying opportunities for improvement.

The leadership of the Orthopaedic Section is highly supportive of these initiatives and believes that they will positively impact the practice of orthopaedic physical therapy. It is believed that the evidence-based clinical practice guidelines and the National Orthopaedic Physical Therapy Outcomes Database will help physical therapists answer the question, "How do you know that you are providing the best possible care for your patient?"

Orthopaedic Section, APTA, Inc.

Combined Sections Meeting 2011

Preconference Courses

Tuesday, February 8th & Wednesday, February 9th, 2011

Tuesday, February 8, 2011 (1-day course)

Move It and Move On: Integrating Manual Therapy and Functional Rehab of the Shoulder Girdle

DESCRIPTION: This lab-intensive course is designed to serve as the link between selected manual therapy interventions and functional rehabilitation of the shoulder girdle. Manual therapy techniques, both thrust and non-thrust, will be presented targeting the thoracic spine and shoulder. Strategies for exercise intervention will highlight the regional interdependence between the shoulder girdle and the rest of the kinetic chain. Selected case studies will demonstrate the effective integration of manual therapy and functional exercise techniques.

OBJECTIVES: Upon completion of this course, you will be able to:

1. Incorporate self-report measures, history, and physical examination based on evidence from the literature into clinical decision-making; 2. Demonstrate clinical examination skills for the thoracic spine and shoulder girdle; 3. Demonstrate manual therapy and exercise intervention strategies based on the diagnosis and current evidence for patients/clients with thoracic spine and shoulder disorders; 4. Describe therapeutic exercise strategies based on movement impairments of the shoulder girdle and kinetic chain.

SPEAKERS: Robert Boyles, PT, DSc, OCS, FAAOMPT; Danny J. McMillian, PT, DSc, OCS, CSCS
LEVEL: Intermediate

Wednesday, February 9, 2011 (1-day course)

Orthopaedic Manual Physical Therapy for the Lower Extremity: Evidence, Evaluation, and Intervention

DESCRIPTION: A progressive hands-on course with emphasis on clinical skills for in-depth manual examination and treatment of osteoarthritis (OA) in the lower extremity. The focus will be on the hip and knee; however, associated management of the entire lower extremity will be included. The speakers have been actively engaged in this line of clinical research for 15 years. The current evidence regarding OMPT for individuals with lower extremity OA will be presented, followed by a laboratory session with hands-on instruction in OMPT evaluation and treatment techniques. Upon completion, participants will be familiar with the body of evidence for manual physical therapy, feel comfortable with an advanced competency manual examination (differing from a diagnostic orthopaedic examination), and make precise intervention decisions with minimal risk to patients. Participants will be able to reinforce clinical treatment with exercise programs designed by manual physical therapists based on best evidence and targeted to relevant impairments identified through the manual examination. All techniques presented have been selected from high quality published physical therapy research, some of which the presenters have contributed to, and continue to use in their current clinical research and practice.

OBJECTIVES: Upon completion of this course, you will be able to:

1. Be familiar with the current state of the evidence regarding OMPT management of individuals with hip or knee OA; 2. Be able to compare the strength of the evidence for OMPT against other nonsurgical and surgical interventions; 3. Be familiar with a basic and advanced skill-set of OMPT examination techniques of the lower extremity for individuals with hip or knee OA; 4. Be familiar with a basic and advanced skill-set of thrust and non-thrust mobilization/manipulation techniques for individuals with hip or knee OA; 5: Be familiar with clinical decision-making strategies used in OMPT management of patients with hip or knee OA.

SPEAKERS: Gail Deyle, PT, DSc, DPT, OCS, FAAOMPT; Skip Gill, PT, DSc, OCS, Cert. MDT, FAAOMPT; Ben Hando, PT, DSc, OCS, FAAOMPT ; Daniel Rhon, PT, DPT, DSc, OCS, FAAOMPT
LEVEL: Intermediate

1-DAY COURSE PRICING:

Membership Level	Early-bird 12/15/10	Advance 1/12/11	On-site
PT & PTA Section Mbr	$280	$305	$330
APTA PT & PTA Section Mbr	$340	$365	$390
Non-Mbr	$400	$425	$450
Section Student Mbr	$180	$205	$230
APTA Student Mbr	$240	$265	$290
Student Non-mbr	$300	$325	$350

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Tuesday & Wednesday, February 8 – 9, 2011 (1 ½ day course)

Placing Physical Therapists at the Center of Fitness, Health Promotion, and Wellness

DESCRIPTION: Part 1 will present the public health context and necessity of PTs taking a central role in fitness, health promotion, and wellness. Part 2 will present case studies of the PT fitness intervention for under-exercisers with and without co-morbidities. Part 3 will discuss the importance of specificity of exercise prescription. Part 4 will present large and small scale models of integrating fitness into physical therapy practice in a way that is cost effective and beneficial to society.

OBJECTIVES: Upon completion of this course, you will be able to:
1. Participants will correctly identify the public health context, rationale and evidence for physical therapists taking a central role in fitness and health promotion; 2. Participants will correctly identify the knowledge, skills, and abilities required to conduct a credible physical therapist-based fitness assessment; 3. Participants will be able to apply fitness-based tests and measures to an under-exercising patient population with and without co-morbidities; 4. Participants will be able to distinguish between general exercise recommendations and specific exercise prescription to meet their patient's needs; 5. Participants will be able to implement specific program planning for a fitness-focused venture in their own market, as well as analyze the analyze the return on investment and the net revenue generating potential of implementing physical therapist-based fitness programs.

SPEAKERS: Carl DeRosa, PT, PhD; Jennifer Gamboa, DPT, OCS, MTC; Reed Humphrey, PT, PhD; Steve Tepper, PT, PhD
LEVEL: Intermediate

Tuesday & Wednesday, February 8 – 9, 2011 (2-day course)

Tai Chi Fundamentals® Program Professional Training Seminar Levels One and Two: Applications for Therapeutic Exercise, Wellness, and Function

DESCRIPTION: In this 2-day course, participants learn the 12 Movement Patterns of the Tai Chi Fundamentals® (TCF) Program, and their seated adaptations, the first section of the TCF form, and the movements of the Seated ROM Dance®. Course combines lecture, movement labs, biomechanics, applications, and documentation. Tai Chi movement is introduced in a motor development progression integrating mind/body exercise components into instruction, including breathing, sensory awareness, and visualization. Includes applications as therapeutic assessment and intervention tools. Course qualifies for APTA CEUs and partial contact hours fulfillment for TCF Instructor Certification Levels One and Two. NOTE: Certification requires 30 contact hours, additional fees, written and movement exams.

OBJECTIVES: Upon completion of this course, you will be able to:
1. Demonstrate 12 Tai Chi Fundamentals® Movement Patterns and their seated adaptations; 2. Describe the medical, biomechanical, and functional benefits of Tai Chi; 3. Integrate Tai Chi's somatosensory, proprioceptive, sensorimotor elements into treatment protocols; 4. Apply Tai Chi as therapeutic exercise for function, rehabilitation, and wellness; 5. Document Tai Chi as part of therapeutic treatment intervention; 6. Discuss evidence-based practice for Tai Chi in physical therapy practice.

SPEAKERS: Kristi Hallisy, PT, MS, OCS, CMPT, CTI; Tricia Yu, MA
LEVEL: Multiple

1 ½-DAY COURSE ("*Placing Physical Therapists…*") PRICING:

Membership Level	Early-bird 12/15/10	Advance 1/12/11	On-site
PT & PTA Section Mbr	$305	$330	$355
APTA PT & PTA Section Mbr	$365	$390	$415
Non-Mbr	$425	$450	$475
Section Student Mbr	$205	$230	$255
APTA Student Mbr	$265	$290	$315
Student Non-mbr	$325	$350	$375

2-DAY COURSE ("*Tai Chi Fundamentals…*") PRICING:

Membership Level	Early-bird 12/15/10	Advance 1/12/11	On-site
PT & PTA Section Mbr	$330	$355	$380
APTA PT & PTA Section Mbr	$390	$415	$440
Non-Mbr	$450	$475	$500
Section Student Mbr	$230	$250	$280
APTA Student Mbr	$290	$315	$340
Student Non-mbr	$350	$375	$400

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Management of Patients Following a Rotator Cuff Repair: A Case Report

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ABSTRACT

Background & Purpose: Various physical therapy postoperative protocols are used to treat patients following a rotator cuff repair. The purpose of this case report is to describe the outcomes of two patients who underwent a rotator cuff repair treated with two different physical therapy protocols. **Methods:** Two patients were seen in physical therapy following right rotator cuff repair. Patient 1 was treated 3 times per week and patient 2 was treated one time per week. Passive glenohumeral motion, Numerical Pain Rating Scores, and Disability of the Arm, Shoulder, and Hand (DASH) scores were used to measure patient progress. **Findings:** Both patients made positive gains in passive range of motion, pain rating scores, and DASH scores. **Clinical Relevance:** Positive gains in range of motion, pain, and function were seen in two patients following a rotator cuff repair despite the differences in the frequency in which they were treated in physical therapy.

Key Words: physical therapy, rehabilitation, rotator cuff, shoulder, rotator cuff surgery, functional recovery

BACKGROUND & PURPOSE

Tears of the rotator cuff can lead to debilitating shoulder dysfunctions and impairments including pain, weakness, and difficulty sleeping.[1] Rotator cuff tears are generally classified as partial-thickness or full-thickness. Partial-thickness tears do not extend through the full depth of the tendon, whereas full-thickness tears extend through the full depth of the tendon.[2] Full-thickness tears decrease muscle strength around the glenohumeral joint[3] that can disrupt normal joint function. Surgical repair is one treatment option following a tear of these tendons and indications for this avenue include pain that is difficult to manage and interferes with daily life, functional deficits, and failure to respond to conservative management.[4]

Following surgical repair of the rotator cuff, physical therapy is often used to regain motion, muscular strength, muscular endurance, and function of the glenohumeral joint. Various postoperative protocols exist for these patients; however, each follows the same general progression.[4] The first stage of most protocols includes passive motion of the glenohumeral joint to regain the mobility, promotion of pain control, and patient education.[4] The major goals of the second stage of rehabilitation generally include improving neuromuscular control and strength around the glenohumeral joint and regaining normal scapular rhythm.[4] Improving muscular endurance around the glenohumeral joint and initiating return to function are the goals of the third stage.[4] Return to sports, occupation, and desired recreational activities are generally not begun until the fourth stage of rehabilitation.[4]

The frequency at which patients should be seen by a physical therapist following a rotator cuff repair to achieve functional goals is a topic of debate, and little research has been done with regard to this matter. Previous research has addressed this issue for other surgical procedures such as anterior cruciate ligament reconstruction.[5-8] Grant et al[5] found that patients treated with a home based exercise program and patients treated with a standard physical therapy program following an anterior cruciate ligament repair had comparable outcomes with regard to knee range of motion during gait, ligamentous laxity, and isokinetic quadriceps and hamstring strength after a 3-month period. In this study, the home based group did have significantly greater knee flexion and extension motion. Other studies comparing home based and standard physical therapy protocols have found similar results with regard to range of motion, ligamentous laxity, and strength in patients following anterior cruciate ligament reconstruction.[7,8] Such findings may generalize to other postsurgical rehabilitation protocols, including rotator cuff repairs.

More research needs to be done to determine how often patients following a rotator cuff repair should be seen by a physical therapist to produce the best functional outcomes. The purpose of this case report is to describe the outcomes of two patients who underwent a rotator cuff repair treated with two different physical therapy protocols. Patient 1 was treated in therapy 3 times per week and patient 2 was treated one time per week.

METHODS

Patient History

Patient 1

The patient was a right-handed, 89-year-old female referred to physical therapy 6 weeks status post a right rotator cuff repair. Prior to surgery, she had been having right shoulder pain for 4 months and was unable to recall a specific event that caused her pain. A magnetic resonance imaging study (MRI) was completed and revealed a large tear (tear 5 cm or greater)[9] of the right rotator cuff tendons and a type II acromion.[10] It was unknown by the physical therapist which rotator cuff muscles were damaged due to limited access to the operative report. The patient underwent a mini-open repair of her right rotator cuff[1] and correction of the acromion via acromioplasty.

The patient reported the postoperative instructions given to her by her physician included wearing a sling on her right upper extremity at all times and refraining from lifting anything heavier than a coffee mug with her right upper extremity for 6 weeks. She was also given instructions to perform Codman's exercises frequently throughout the day. Codman's exercises use gravity to distract the humerus from the glenoid fossa, which aids in pain reduction through gentle distraction and oscillatory movements.[11] It also provides early movement of the joint structures.[11] At the time of initial evaluation in physical therapy, the patient reported difficulty dressing, cooking, bathing, grooming, eating, and using the telephone with her right upper extremity.

The referring physician's order for physical therapy stated passive range of motion was to be applied to the patient's right upper extremity and active range of motion was to commence when deemed appropriate by the therapist. Strengthening of the right upper extremity was not to be initiated until the patient's follow up appointment with the physician 6 weeks later.

Patient 2

The patient was a right-handed, 83-year-old female referred to physical therapy two days status post a right rotator cuff repair. Prior to surgery, she had been having right shoulder pain for one and a half years with use of her right upper extremity and during sleep. She could not recall a particular event that preceded her pain. An MRI was completed prior to surgery and confirmed a full-thickness tear of the right supraspinatus tendon, a type III acromion,[10] and osteophytic spur formation at the undersurface of the acromioclavicular joint. The patient received subacromial injections prior to electing to proceed with surgical interventions. The injections did not create lasting pain relief with activity or sleeping. She underwent an arthroscopic subacromial decompression and rotator cuff repair[1] with removal of the ossified portion of the acromioclavicular ligament.

The patient received postoperative instructions from the referring physician including wearing a sling at all times and not lifting anything heavier than a coffee mug for 6 weeks. At the time of initial evaluation, she reported difficulty with activities such as washing and combing her hair, sleeping in a supine position, performing cleaning and cooking activities, and putting on a shirt.

The referring physician's order stated passive range of motion was to be applied to the patient's right upper extremity for 6 weeks. After this time, active range of motion exercises could commence. Strengthening exercises were not to be initiated prior to reassessment by the referring physician at 12 weeks.

Based on both patients' medical diagnosis and functional limitations, it was deemed appropriate to continue with further examination to focus the plan of care.

Examination

Multiple screening and examination tools were used to determine each patient's impairments, functional limitations, and disabilities during the physical therapy examination and were selected based on the restrictions placed by the referring physician. A review of the cardiovascular, integumentary, musculoskeletal, and neuromuscular system was completed and significant findings are reported in Table 1. Upon initial examination, both patients wore a sling on their right upper extremity. Passive range of motion for each patient's glenohumeral and elbow joint was evaluated through goniometric measurement to determine which joint movements limited function (Tables 2 & 3). The use of a goniometer to measure glenohumeral range of motion has been shown to have high intratester reliability.[12] Passive glenohumeral and elbow range of motion was measured in the supine position. Active glenohumeral and elbow range of motion was also measured using a goniometer for patient 1 in a seated position. Active glenohumeral motion was not tested for patient 2 as the referring physician indicated only passive movements were to be performed for the first 6 weeks postsurgery. Muscle strength testing was not performed with either patient due to the restrictions placed by the referring physician and as a consequence of the recent surgery.

The Numerical Pain Scale was used to assess the patients' pain. This is a 0 to 10 scale in which a score of 0 is defined as no pain and 10 is defined as the worst pain imaginable. This scale has been shown to be valid in postsurgical patients.[13,14] Patient 1 described her pain as being intermittent in nature and rated it at best as a 0/10 and at worst as a 4/10. Rest decreased her pain and lifting her arm and supinating her forearm increased her pain. Patient 2 described her pain as intermittent and at best as a 0/10 and at worst as a 3/10. She stated rest decreased her pain and using her arm for any activity increased her pain.

The DASH questionnaire was administered to patient 1 at initial evaluation, week 5, and week 10. It was administered to patient 2 at initial evaluation, 5 weeks, and 10 weeks. This tool is a 30 item questionnaire used to assess difficulty in performing activities that require the use of the upper extremity[15] (Appendix A). It also addresses symptoms of pain, activities that cause pain, tingling, weakness, and stiffness.[15] The impact of symptoms on social activities, work, sleep, and psychological well-being is assessed as well.[15] The scores on the DASH range from 0 to 100, where 0 is defined as least disability and 100 is defined as most disability.[15] The DASH has been shown to have acceptable reliability and validity for clinical use.[15] Patient 1 scored a 53.25/100 and patient 2 scored a 70.75/100 upon initial evaluation.

Table 1. Results from Systems Review

System Reviewed	Patient 1	Patient 2
Cardiovascular/Pulmonary	No significant abnormal findings for blood pressure and heart rate.	Not tested.
Integumentary	Dry and healing incision on anterior aspect of right shoulder. Skin breakdown on medial aspect of right elbow due to sling use.	Dry and healing incision on the right shoulder. Skin breakdown on sternum due sling use.
Musculoskeletal	Decreased right upper extremity range of motion. Atrophy of the right supraspinatus and infraspinatus muscles.	Decreased right upper extremity range of motion.
Neuromuscular	No significant abnormal findings for balance, coordination, and gait.	No significant abnormal findings for balance, coordination, and gait.

Evaluation

Patient 1

The patient presented to physical therapy with decreased shoulder passive and active motion in shoulder flexion, abduction, extension, and external rotation, as well as decreased active and passive elbow extension that limited the patient's ability to dress herself, cook, bathe and groom herself, eat, and use the telephone independently. According to the Guide for Physical Therapist Practice[16] this patient fit into the Practice Pattern 4I: impaired joint mobility, motor function, muscle performance, and range of motion associated with bony or soft tissue surgery. The patient's goal was to return to her level of function prior to injury. She presented with a good prognosis for reaching her goal due to her high levels of motivation and the assistance that could be provided by her spouse.

Patient 2

The patient presented to physical therapy with decreased passive shoulder flexion and external rotation that limited her ability to wash and comb her hair, sleep undisturbed, perform cleaning and cooking activities, and dress independently. According to the

Guide for Physical Therapist Practice[16] this patient fit into the Practice Pattern 4I: impaired joint mobility, motor function, muscle performance, and range of motion associated with bony or soft tissue surgery. The patient's goals were to be pain free, have normal range of motion and strength, perform activities of daily living without restriction, sleep normally, and wash and comb her hair independently. The patient presented with good prognosis with regard to her goals due to the assistance that could be provided by her husband and family and her high levels of motivation to begin therapy.

Interventions for patient 1 and 2 were geared toward the patients' goals and incorporated techniques that would address the underlying impairments established during the examination.

Interventions

The physical therapy exercises used to treat each patient and the frequency with which each patient was seen in therapy were based on the initial examination findings and the protocol used at the facility where they were treated. Patient 1 was treated by a student physical therapist under the direct supervision of a physical therapist with 12 years of experience 3 times per week using the protocol and home exercise program outlined in Table 4. Patient 2 was treated by the same student physical therapist under the direct supervision of a physical therapist with 30 years of experience one time per week using the protocol and home exercise program outlined in Table 5. The orders received from the physician played a role in how quickly the patients were progressed through their rehabilitation.

Each patient began their rehabilitation with the focus on gaining passive range of motion of the glenohumeral joint. This was achieved through manual stretching and passive range of motion done by the student physical therapist with the patient in the supine position. Passive and active range of motion exercises were also given to the patients based on the finding from the initial examination to promote and maintain normal elbow, wrist, and hand function. Each patient was treated for 30 minutes per session with 70% of the session focusing on manual stretching and passive range of motion performed by the student physical therapist. The remaining 30% of the therapy sessions were focused on review and progression of the home exercise program. Patient 1 began therapy 6 weeks following her rotator cuff repair, therefore, she completed the passive exercises described in Table 4 (weeks 0-6) for one week. After this time, she began the active assistive exercises described in weeks 7-12. Patient 2 began therapy two days following surgery and completed the passive exercises described in Table 5 (weeks 0-6) for 6 weeks to increase the mobility of the glenohumeral joint.

Rehabilitation and home exercise programs were progressed from a focus on passive range of motion to active assistive range of motion during week two for patient 1 and week 6 for patient 2. The progression was deemed appropriate by the physical therapist when the patient could perform the passive exercises without increasing her pain and when the patient could perform 10 repetitions of the active assistive range of motion exercises without reports of increasing pain and without substitution. Whether or not the patient was substituting with other muscles around the glenohumeral joint during the active assistive exercises was determined by visual observation of the patient completing the exercises.

Active range of motion exercises were initiated when the patient could perform the active assistive exercises without increasing her pain and without substitution. In addition, the patient was required to complete 10 repetitions of the active exercises without increasing their pain and without substitution by other muscles around the glenohumeral joint. Before the active exercises were progressed to strengthening exercises, the patients were reassessed by the referring physician to make sure this progression was appropriate and would not damage the newly repaired tissues.

Strengthening exercises generally occurred when the patient was 12 weeks postoperative and following reassessment by the referring physician. Given this protocol, patient 1 began strengthening exercises during week 6 of physical therapy. Dumbbells and Thera-Band were used to apply resistance to the muscles. Selection of the appropriate amount of resistance for each patient was determined based on pain level and visual observation of substitution

Table 2. Patient 1: Upper Extremity Range of Motion upon Initial Evaluation

Motion	Active (degrees)	Passive (degrees)
Shoulder flexion	41	64
Shoulder external rotation	11	19
Elbow flexion	140	144
Elbow extension	-90	-57
Supination	80	80
Pronation	80	80

Table 3. Patient 2: Upper Extremity Range of Motion upon Initial Evaluation

Motion	Active (degrees)	Passive (degrees)
Shoulder flexion	Not tested due to referring physician order	90
Shoulder external rotation	Not tested due to referring physician order	5
Elbow flexion	Within Normal Limits (WNL)*	WNL*
Elbow extension	WNL*	WNL*
Supination	WNL*	WNL*
Pronation	WNL*	WNL*

*As defined by the American Academy of Orthopaedic Surgeons standards (Norkin & White, 2003)

Table 4. Rotator Cuff Repair Postoperative Protocol for Patient 1

Postoperative Week	In-clinic Interventions	Home Exercises
0-6	- Manual passive range of motion (PROM) of glenohumeral joint in all planes -Cryotherapy for pain control	-Codman's exercises (flexion, extension, abduction, adduction, internal rotation, external rotation) - Pulley exercises (flexion and scaption) - Wand assisted glenohumeral external rotation stretch - Stretching of the elbow, wrist, and hand - Cryotherapy for pain control
7-12	- Continue manual PROM until full motion is obtained - Active assistive glenohumeral flexion progressing from supine to seated -Active glenohumeral flexion, scaption, external rotation, and supine scapular protraction	- Pulley exercises until full passive range of motion achieved - Wand assisted glenohumeral external rotation stretch until full range of motion achieved - Active assistive glenohumeral flexion - Active glenohumeral flexion, scaption, side-lying external rotation, and supine scapular protraction
>12 (or cleared by physician)	- Strengthening exercises for glenohumeral flexion, abduction, external rotation, and scapular protraction - Upper extremity bike	- Strengthening exercises for glenohumeral flexion, abduction, external rotation, and scapular protraction

Frequency: patient was seen by the physical therapist: 3 times per week

Table 5. Rotator Cuff Repair Postoperative Protocol for Patient 2

Postoperative Week	In-clinic Interventions	Home Exercises
0-6	- Manual passive range of motion (PROM) of glenohumeral joint in all planes -Isometric flexion, extension, abduction, adduction, internal rotation, and external rotation (not performed until week 4) -Cryotherapy for pain control	-Codman's exercises (flexion, extension, abduction, adduction, internal rotation, external rotation) - Pulley exercises (flexion and scaption) - Wand assisted glenohumeral external rotation stretch - Stretching of the elbow, wrist, and hand -Isometric flexion, extension, abduction, adduction, internal rotation, and external rotation (not performed until week 4) -Cryotherapy for pain control
7-12	- Continue manual PROM until full motion is obtained -Active glenohumeral flexion, scaption, external rotation, and supine scapular protraction -Upper extremity bike	- Pulley exercises until full passive range of motion achieved - Wand assisted glenohumeral external rotation stretch until full range of motion achieved - Active assistive glenohumeral flexion - Active glenohumeral flexion, scaption, external rotation, and supine scapular protraction
>12 (or cleared by physician)	- Strengthening exercises for glenohumeral flexion, abduction, external rotation, and scapular protraction - Upper extremity bike	- Strengthening exercises for glenohumeral flexion, abduction, external rotation, and scapular protraction

Frequency: patient was seen by the physical therapist: 1 time per week

by other muscles around the glenohumeral joint while performing each exercise.

In addition to the treatment provided in the clinic, each patient was given a home exercise program that was completed 3 times each day. The home exercises were chosen based on the clinic's protocol (Table 4 and 5) and consisted of passive, active assistive, and active range of motion exercises. The patients were told the exercises should not increase the pain in their right shoulder during or upon completion. If their pain increased, they were instructed to decrease the number of repetitions or decrease the frequency to two times per day until the pain resolved. The patients' home exercise program was progressed when the patient could perform a given exercise without increasing pain and without substitution by other muscle groups.

FINDINGS

Patient 1

The patient began physical therapy 6 weeks postoperatively for a total of 10 weeks. During this time, she was seen 3 times per week. Table 6 outlines the patient's gains in passive and active glenohumeral and elbow range of motion, her Numerical Pain Rating scores, and the results of the DASH over the 10-week period. The patient's passive and active range of motion increased over her time in physical therapy; however, her glenohumeral motion remained below normal levels according to the American Academy of Orthopaedic Surgeons' (AAOS) standards[17] for all motions measured except passive external rotation. Bovens et al[18] has shown the standard deviation of repeated range of motion measurements using a goniometer is 5°. Therefore, a positive improvement in range of motion was an increase of 5°. The patient's reported pain level, as measured by the Numerical Pain Scale, decreased from 4/10 at initial evaluation to 0/10 at discharge. The patient showed clinically meaningful improvements in her DASH scores (a change of 10.5 points) from initial

Table 6. Outcomes for Patient 1

Therapy Week	Postop Week	Passive glenohumeral flexion (degrees)	Passive glenohumeral external rotation (degrees)	Passive elbow extension (degrees)	Active glenohumeral flexion (degrees)	Active glenohumeral abduction (degrees)	DASH Score	Numerical Pain Rating Scale
1	6	64	19	-57	41	46	53.25	4
5	10	137	50	0	115	72	15	0
10	15	157	87	0	128	108	7.5	0

Table 7. Goals for Patient 1 and 2

Physical Therapy Goals for Patient 1	Physical Therapy Goals for Patient 2
Short Term Goals: 1. Patient will improve her active flexion from 41° to 90° to enable her to dress independently and eat independently using her right upper extremity in 4 weeks. Met. 2. Patient able to use the telephone with her right upper extremity independently in 4 weeks. Met. Long Term Goals: 1. Patient able to improve her shoulder flexion actively from 41° to 140° to enable her to retrieve objects out of a cupboard within 8 weeks. Not met. 2. Patient able to independently perform cooking at home in 8 weeks. Met.	Short Term Goals: 0-6 weeks 1. Decrease pain by 50% to allow the patient to sleep for 4-6 hours uninterrupted. Met. 2. PROM forward elevation 0-170°, ER 0-80. Not met. 3. Allow enough motion to assist with dressing self and other ADLs maintaining passive motion only. Met. Mid Range Goals: 6-12 weeks 1. AROM sufficient to allow the patient to use upper extremity for dressing, washing, combing hair, and below shoulder ADLs. Met. 2. Full PROM throughout all planes. Not met. Long Term Goals: 12 -24 weeks 1. Regain full functional AROM, strength of rotator cuff, and upper extremity to perform all work and home ADLs and preinjury level of function. Met. 2. Resolution of shoulder pain. Met.

evaluation to week 5.[15] Clinically meaningful change is the smallest change in score that likely reflects a true difference.[19] The change in her DASH score seen from week 5 to week 10 was not clinically meaningful.

Functionally, the patient reported she was better able to use her right upper extremity for activities such as dressing, eating, cooking, and using the telephone following the 10-week period in physical therapy. The patient met all personal goals and all but one goal set by the physical therapist (Table 7) at the time of discharge.

Patient 2

The patient began physical therapy two days postoperatively for a total of 10 weeks with a reassessment 3 weeks later. The reassessment was completed to assure the patient was continuing to make positive gains. During this time she was treated one time per week. Table 8 outlines the passive and active range of motion, her Numerical Pain Rating Scores, and results of the DASH over this time period. The patient's passive range of motion increased during her time in physical therapy, however, she failed to regain normal levels of passive glenohumeral flexion according to AAOS standards.[17] Her pain rating scores decreased from 3/10 at initial evaluation to 0/10 at week 10 and reassessment. The results from the DASH questionnaire showed clinically meaningful improvements from the time of initial evaluation to week 5. The change in her DASH score from week 5 to week 10 was not clinically meaningful.

Functionally, the patient reported she was better able to sleep in a supine position and dress herself using her right upper extremity. The patient met all her personal goals; however, she did not meet all of her physical therapy goals in 10 weeks (Table 7).

CLINICAL RELEVANCE

Physical therapists frequently treat patients following a rotator cuff repair. The lack of evidence on the most effective protocol can make it difficult for therapists to choose the best treatment approach for these patients. This case report described the outcomes of two patients following a rotator cuff repair treated with two different physical therapy protocols.

Following treatment by a physical therapist, patient 1 and patient 2 displayed favorable outcomes with regard to changes in range of motion, decreased pain rating scores, decreased scores on the DASH, and their ability to meet personal and physical therapy goals. Based on the outcome data collected in these two cases, patient 1 and patient 2 made comparable gains in passive range of motion and pain relief despite the differences in the frequency the patients were seen in physical therapy. However, patient 1 had a lower score on the DASH at week 5 and 10 than did patient 2. This indicates patient 1 felt she was able perform activities requiring the use of her right upper extremity with greater ease. The large discrepancy in these scores may be explained by the difference in the amount of time that had passed since the patients' surgeries. This difference could also be explained by the differences in the restrictions placed on the patients at the time of completing the questionnaire. Patient 1 completed this

Table 8. Outcomes for Patient 2

Therapy Week	Postop Week	Passive glenohumeral flexion (degrees)	Passive glenohumeral external rotation (degrees)	Passive elbow extension (degrees)	Active glenohumeral flexion (degrees)	Active glenohumeral abduction (degrees)	DASH Score	Numerical Pain Rating Scale
1	1	90	5	0	Not tested*	Not tested*	70.75	3
5	5	155	71	0	Not tested*	Not tested*	35.75	0
10	10	165	80	0	130	55	29.16	0
13	13	165	85	0	135	75	Not tested†	

* Not tested due to orders from referring physician stating no active range of motion for 6 weeks
† Patient preferred not to complete the questionnaire

questionnaire at 5 weeks and was no longer required to wear a sling. Patient 2 was still wearing a sling to protect the repaired tendons that may have limited her ability to complete daily tasks.

Limited studies have been performed regarding the frequency patients should be seen in physical therapy following a rotator cuff repair. Hayes et al[20] compared the short- and long-term effects for patients treated one time for instruction in a home exercise program and patients treated weekly by a physical therapist. Fifty eight subjects were recruited for this study and outcome measures included range of motion, muscle force, and functional outcomes as measured by The Shoulder Service Questionnaire. The home based group was given a 3 phase exercise program that was progressed and issued by the surgeon. All aspects of treatment including exercises, rate of progression, frequency of treatment, and number of sessions treated was determined by a physical therapist for the physical therapy group. The average number of sessions the patients were treated in the physical therapy group was 16 ± 11 over 17 ± 9 weeks. The outcome measures were assessed preoperatively, at 6 weeks, 12 weeks, and 24 weeks for each group. The study results indicated that the patient treated one time for instruction in a home exercise program and the patient treated weekly by a physical therapist had comparable outcomes with regard to range of motion, muscle force, and functional outcomes.

The issue of economics arises when comparing the costs of the two rehabilitation protocols used in this case report. The cost of an evaluation for patient 1 was $119.00 and the average cost of a physical therapy visit was $69.00. Patient 1 was seen for approximately 30 visits making her total physical therapy cost $2,189.00. The cost of an evaluation for patient 2 was $124.00. Patient 2 was seen for a total of 11 visits with the cost of an average physical therapy visit being $67.00. Her total physical therapy cost was $861.00. The difference in cost between the two patients was $1,328.00 and similar outcomes were obtained by each patient regardless of the therapy protocol used. Assuming that outcomes following rotator cuff surgery are not negatively impacted and that similar cost savings can be realized, one might logically advocate for reduced numbers of physical therapy visits during the rehabilitation process.

A few limitations of this case report should be noted. First, the patients underwent different surgical procedures to repair their rotator cuff. The amount of damage done to the structures surrounding the rotator cuff tendons differs between the two surgical procedures. This may account for the differences in the outcomes for each patient. Second, the specific rotator cuff tendons repaired were unknown for patient 1 making it difficult to compare these two patients as the extent of injury may have differed. Third, the time from surgery to the time seen by a physical therapist was different for each patient. The differences in postoperative time make it difficult to compare these two cases as the interventions being applied to the patients during given weeks in therapy were different. Furthermore, the differences in postoperative time make it difficult to compare these patients as the newly repaired tendons were in different phases of healing. Fourth, both patients were treated by the same student physical therapist which may have introduced bias as it was known by the examiner which patient was being treated 1 versus 3 times per week. Finally, due to the fact that this was a case description, one cannot infer that the patients improved due to the interventions applied nor can it be said that the differences in outcomes of the two patients was due to the differences in the protocols used. In addition the long term success of either patient with regard to complete return to function or reinjury (greater than one year) cannot be determined from the current study design.

Future research should compare physical therapy protocols in an attempt to determine the most effective treatment for patients following a variety of surgical procedures. Not only should these studies focus on the most effective interventions for rehabilitation, but they should also focus on the frequency with which a physical therapist should be treating these patients to obtain the best long-term results. In addition, further research should focus on the cost-effectiveness of various physical therapy protocols.

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(Appenix A follows on pages 227-230)

Appendix A Continued. The Disability of the Arm, Shoulder, and Hand Questionnaire (pages 227-230).

Disabilities of the Arm, Shoulder and Hand

Please rate your ability to do the following activities in the last week by circling the number below the appropriate response.

	NO DIFFICULTY	MILD DIFFICULTY	MODERATE DIFFICULTY	SEVERE DIFFICULTY	UNABLE
1. Open a tight or new jar.	1	2	3	4	5
2. Write.	1	2	3	4	5
3. Turn a key.	1	2	3	4	5
4. Prepare a meal.	1	2	3	4	5
5. Push open a heavy door.	1	2	3	4	5
6. Place an object on a shelf above your head.	1	2	3	4	5
7. Do heavy household chores (e.g., wash walls, wash floors).	1	2	3	4	5
8. Garden or do yard work.	1	2	3	4	5
9. Make a bed.	1	2	3	4	5
10. Carry a shopping bag or briefcase.	1	2	3	4	5
11. Carry a heavy object (over 10 lbs).	1	2	3	4	5
12. Change a lightbulb overhead.	1	2	3	4	5
13. Wash or blow dry your hair.	1	2	3	4	5
14. Wash your back.	1	2	3	4	5
15. Put on a pullover sweater.	1	2	3	4	5
16. Use a knife to cut food.	1	2	3	4	5
17. Recreational activities which require little effort (e.g., cardplaying, knitting, etc.).	1	2	3	4	5
18. Recreational activities in which you take some force or impact through your arm, shoulder or hand (e.g., golf, hammering, tennis, etc.).	1	2	3	4	5
19. Recreational activities in which you move your arm freely (e.g., playing frisbee, badminton, etc.).	1	2	3	4	5
20. Manage transportation needs (getting from one place to another).	1	2	3	4	5
21. Sexual activities.	1	2	3	4	5

Appendix A Continued. The Disability of the Arm, Shoulder, and Hand Questionnaire (pages 227-230).

Disabilities of the Arm, Shoulder and Hand

	NOT AT ALL	SLIGHTLY	MODERATELY	QUITE A BIT	EXTREMELY
22. During the past week, *to what extent* has your arm, shoulder or hand problem interfered with your normal social activities with family, friends, neighbours or groups? *(circle number)*	1	2	3	4	5

	NOT LIMITED AT ALL	SLIGHTLY LIMITED	MODERATELY LIMITED	VERY LIMITED	UNABLE
23. During the past week, were you limited in your work or other regular daily activities as a result of your arm, shoulder or hand problem? *(circle number)*	1	2	3	4	5

Please rate the severity of the following symptoms in the last week. *(circle number)*

	NONE	MILD	MODERATE	SEVERE	EXTREME
24. Arm, shoulder or hand pain.	1	2	3	4	5
25. Arm, shoulder or hand pain when you performed any specific activity.	1	2	3	4	5
26. Tingling (pins and needles) in your arm, shoulder or hand.	1	2	3	4	5
27. Weakness in your arm, shoulder or hand.	1	2	3	4	5
28. Stiffness in your arm, shoulder or hand.	1	2	3	4	5

	NO DIFFICULTY	MILD DIFFICULTY	MODERATE DIFFICULTY	SEVERE DIFFICULTY	SO MUCH DIFFICULTY THAT I CAN'T SLEEP
29. During the past week, how much difficulty have you had sleeping because of the pain in your arm, shoulder or hand? *(circle number)*	1	2	3	4	5

	STRONGLY DISAGREE	DISAGREE	NEITHER AGREE NOR DISAGREE	AGREE	STRONGLY AGREE
30. I feel less capable, less confident or less useful because of my arm, shoulder or hand problem. *(circle number)*	1	2	3	4	5

DASH DISABILITY/SYMPTOM SCORE = $\left[\left(\frac{\text{sum of n responses}}{n}\right) - 1\right] \times 25$, where n is equal to the number of completed responses.

A DASH score may not be calculated if there are greater than 3 missing items.

DISABILITIES OF THE ARM, SHOULDER AND HAND

WORK MODULE (OPTIONAL)

The following questions ask about the impact of your arm, shoulder or hand problem on your ability to work (including home-making if that is your main work role).

Please indicate what your job/work is:_____

❒ I do not work. (You may skip this section.)

Please circle the number that best describes your physical ability in the past week. Did you have any difficulty:

		NO DIFFICULTY	MILD DIFFICULTY	MODERATE DIFFICULTY	SEVERE DIFFICULTY	UNABLE
1.	using your usual technique for your work?	1	2	3	4	5
2.	doing your usual work because of arm, shoulder or hand pain?	1	2	3	4	5
3.	doing your work as well as you would like?	1	2	3	4	5
4.	spending your usual amount of time doing your work?	1	2	3	4	5

SPORTS/PERFORMING ARTS MODULE (OPTIONAL)

The following questions relate to the impact of your arm, shoulder or hand problem on playing *your musical instrument or sport or both*. If you play more than one sport or instrument (or play both), please answer with respect to that activity which is most important to you.

Please indicate the sport or instrument which is most important to you:_____

❒ I do not play a sport or an instrument. (You may skip this section.)

Please circle the number that best describes your physical ability in the past week. Did you have any difficulty:

		NO DIFFICULTY	MILD DIFFICULTY	MODERATE DIFFICULTY	SEVERE DIFFICULTY	UNABLE
1.	using your usual technique for playing your instrument or sport?	1	2	3	4	5
2.	playing your musical instrument or sport because of arm, shoulder or hand pain?	1	2	3	4	5
3.	playing your musical instrument or sport as well as you would like?	1	2	3	4	5
4.	spending your usual amount of time practising or playing your instrument or sport?	1	2	3	4	5

SCORING THE OPTIONAL MODULES: Add up assigned values for each response; divide by 4 (number of items); subtract 1; multiply by 25.
An optional module score may <u>not</u> be calculated if there are any missing items.

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PRESIDENT'S MESSAGE

GREETINGS OHSIG MEMBERS!

By the time you read this, 2010 will be nearing its close, we will have a new VP/Ed Chair and Nominating Committee member, and we will be looking ahead to CSM Feb 2011. I want to highlight OHSIG initiatives from 2010, and look ahead to 2011.

OHSIG INVOLVEMENT WITH ACOEM/WCTP/APTA

OHSIG was requested to review foundation chapters for ACOEM (American College of Occupational and Environmental Medicine). The following are in process:

A. IME – Reviewer Sandy Goldstein; Progress: Completed
B. Work Relatedness - Reviewer John Lowe; Progress: Completed
C. Prevention - Reviewer Drew Bossen; In process
D. General Approach to Initial Assessment and Documentation - Reviewer Sandy Goldstein, assistance from Rick Wickstrom; In process
E. Initial Approaches to Treatment – Reviewer John Lowe, assistance from Margot Miller; In process
F. Cornerstone of Disability Prevention and Management - Reviewer Dee Daley; In process

Kathy Rockefeller and Margot Miller reviewed the draft of the WCPT (World Confederation of Physical Therapy) Occupational Health & Safety documents as requested by Anita Bemis-Dougherty, PT, DPT, MAS, Associate Director, Department of Practice, APTA.

It is very positive for OHSIG to be involved and recognized for our expertise. Our input can make a difference for all PTs working in the area of occupational health!

DEFENSIBLE DOCUMENTATION

Defensible documentation is complete. John Lowe and his committee worked with Anita Bemis from APTA on the document, which is expected to have a very positive effect on the quality of physical therapy documentation for injured workers.

The link to the Workers Comp Documentation is on the APTA Web site. It is member protected, so you will need to log in as a member to access: http://www.apta.org/AM/Template.cfm?Section=Documentation4&Template=/MembersOnly.cfm&NavMenuID=2505&ContentID=70685&DirectListComboInd=D

HATS OFF TO OUTGOING OHSIG BOARD MEMBERS - DEE DALEY AND JOHN LOWE

- Dee has been an active member of OHSIG for several years. As VP/Ed Chair, she has coordinated OHSIG education at CSM, she has been involved in revisions of OH guidelines, she has written articles for OPTP, and she is currently spearheading our Petition for Specialization in OH PT.
- John has been an active member of OHSIG for several years. As Nominating Committee Chair, he has secured candidates for OHSIG elections. He has contributed to several guideline revisions, he had a primary role in Defensible Documentation, and more.

We applaud their dedicated commitment to OHSIG. Thank you Dee and John!

DELPHI STUDY ON FUNCTIONAL CAPACITY

Members of the FCE Task Force were asked to become part of a Delphi Study on functional capacity. Members of the Netherland's study group include: Michiel F Reneman, PhD; Harriet Wittink, PhD; Cees P van der Schans, PhD; Jan HB Geertzen, PhD. Watch for updates related to this study.

PETITION FOR SPECIALIZATION IN OCCUPATIONAL HEALTH PT

The petition is nearly completed. Dee Daley leads the efforts along with the entire BOD. We are working on sample test questions. We will keep you posted on the submission and progress of the petition.

GUIDELINES UPDATE

Work Rehabilitation Guideline revision is in process, and should be finalized soon. Other guidelines will be revised in 2010/2011, including Ergonomic and Legal. Two more members with expertise in ergonomics and evidence-based practice to assist with review and updating of the APTA Ergonomics Guidelines are needed. Please notify Rick Wickstrom (rick@workability.us) if you have interest and expertise to contribute to this project.

PAYMENT POLICY LIAISONS REQUESTED

A letter was sent to State Chapter Presidents and Executive Directors asking that a liaison be identified to work with the OHSIG Practice and Payment Policy Committee. Rick Wickstrom, Committee Chair stated that having liaisons "will help us share relevant information with physical therapists, payers, regulators, and other occupational health professionals as a public relations strategy to promote professionalism of physical therapists. We hope that creating state-specific payment policy liaisons for the Occupational Health Special Interest Group will encourage greater networking on matters that impact practice and reimbursement for our specialty - thus reinforcing the benefits of belonging to APTA and the Orthopaedic Section's Occupational Health Special Interest Group."

If you are interested in more information on becoming a liaison, contact Rick Wickstrom at rick@workability.us.

WORKERS' COMPENSATION AUDIO CONFERENCE

We thank Practice and Payment Policy Chair Rick Wickstrom, PT, CPE, CDMS, and Kevin Basile, PT, MSPT, OCS, for working with Karen Jost, PT, MS, Associate Director Payment Policy & Advocacy APTA, on an audio conference regarding worker's compensation. On August 19th they provided the program "Navigating the Tides of Workers' Compensation" that offered attendees new insight to identify the range of services a physical therapist might provide and how to ensure appropriate payment for those services. It also offered techniques for reducing burden through effective identification of and collaboration with all stakeholders, and how to negotiate with the insurers. Thank you all!

CSM 2011 UPDATE- "WHAT'S COOKING FOR NEW ORLEANS"

Every Day Excellence in Workers Compensation: Preventing Needless Disability, Peer Review Gems, Guidelines, and Practical Considerations

Although workers compensation is fairly standard for many outpatient payer mixes, providers often note frustration trying to expand their skill set and master the complexities of working with injured workers. In addition to return to work considerations, navigating multiple stakeholder groups including employer, case managers, adjusters, and various state work comp boards can seem overwhelming.

This 3 hour program is designed to help increase physical therapists and physical therapist assistants comfort and effectiveness in the area of worker rehabilitation. The program covers the latest work rehabilitation guidelines, practice strategies for preventing needless disability and documentation pearls to quickly and easily demonstrate appropriate care patterns. Learn more about the various stages of a work comp cycle, return to work planning, and payment/policy methodologies. Screening criteria for factors that are associated with long term disability and intervention recommendations to improve outcomes /successful return to work will also be included.

Learning Objectives:

1. Describe the course of a worker's compensation claim and how to effectively integrate with other health care professionals and stakeholders.
2. Implement strategies to reduce needless work disabilities and recognize "flags" or barriers that can slow care.
3. Implement treatment strategies for progressive return to work goals based on workplace policies and partnering.
4. Identify APTA work rehab/work injury management guidelines (and other stakeholder groups) and understand the use/implications in your practice.
5. Ensure that documentation is adequate for minimizing reimbursement issues by conveying the necessity for professional level care by a physical therapist.

Brief Session Outline:

1. Life of a work comp claim and case management
   - Steps, stages, and roles of stakeholders
   - Payment methodologies and underlying assumptions
   - Blue flags
2. Preventing needless work disability- principles, concepts, and evidence
   - What shortens/promotes early RTW vs prolongs/delays RTW
3. Options for progressive/guided RTW
4. Implications for clinical practice set up/equipment
5. Guidelines, documentation, and barriers to recovery

Presenters

John Lowe, PT (Also serves as Moderator)
James Hughes, PT
Chris Juneau, PT, DPT, ATC, EMBA
Nicole B. Matoushek, PT, MPH, CEES, CEAS

Also plan to attend the OHSIG member business meeting before the education session. We hope to see you!

OHSIG MEMBER EMAIL BLASTS

Our thanks to Sandy Goldstein, OHSIG Communication Chair, for coordinating the OHSIG member E-mail Blasts. If you did not receive the E-mail blast, contact Sandy at sanfordgoldstein@hotmail.com. Also, if you have information for the E-mail blast, contact Sandy.

AUTHORS NEEDED

We encourage you to become more involved in OHSIG whether serving on a committee or a task force or writing an article or case study for OPTP. It's a great way to share your expertise with others working in this area of practice.

We thank Nicole Matoushek, PT, MPH, for her article in the last OPTP, "What Works in Workers Compensation." Nicole is past treasurer of OHSIG; she is a VP at Align Networks. Also, we thank Alison Heller-Ono, MSPT, CDA, CIE, CPE, for her contribution in this issue of OPTP, "PT as Ergonomist: A Model for 21st Century Health Care." Alison is President/CEO of Worksite International, Inc.

Please contact any of your OHSIG board if you have questions/comments. We'd love to hear from you!

Professional Regards,
Margot Miller, PT
OHSIG President

PT AS ERGONOMIST: A MODEL FOR 21ST CENTURY HEALTH CARE

Alison Heller-Ono, MSPT, CDA, CIE, CPE
Alison is a Certified Management Consultant, President/CEO, Worksite International, Inc. in Pacific Grove, CA. She can be reached at alisonh@worksiteinternational.com.

CURRENT STATE OF THE PT PROFESSION

It is no secret that being a Physical Therapist in the 21st Century is not without its difficulties. Despite good job potential for the next 10 years, a shrinking health care market has

left us begging for Medicare dollars and physician referrals to maintain our traditional practice models and fighting for dominance in the "hands-on" health care marketplace. For sure the motto, "only the strong will survive" is true in today's physical therapy marketplace. With the HMO stranglehold on physicians, rising health care costs, hospital cutbacks as well as a flood of Physical Therapists, Chiropractors, and Massage Therapists into the marketplace during the last 20 years (in 2008 there were 186,000 PTs employed, 50,000 Chiropractors and 122,000 Massage therapists[1]), PTs have been forced to turn their attention to other creative markets. One market segment that holds significant potential for the physical therapist lies within America's core economy, its business and industrial marketplace.

America's workplace continues to thrive despite a dragging economy. Americans are working harder than ever before. In 2007, the International Labor Organization ranked American workers as the most productive in the world.[2] In addition, the USA is ranked third behind Norway and the Republic of Singapore in gross domestic production. Americans dominate the world in farm production, information technology, and the Internet.[3] We have some of the most stringent occupational health and safety laws in the world to protect our workers. The legislators and regulators have gone the extra mile over the last two decades to push for improved working conditions for US workers. Supported by health and safety regulations, workers' compensation labor laws, the ADA, FMLA, and the push for state and federal regulations supporting workplace ergonomics, the PT is in even more demand than ever before in this segment of our economy. These regulations primarily support the prevention and management of musculoskeletal disorders, an area of expertise for physical therapists. In 2008, according to the Bureau of Labor Statistics, there were 416,620 cases involving sprains, strains, and tears to individuals in the workplace. Approximately 222,290 cases involved injuries to the back.[4] Between the legislation and the prevalence of work injury, the writing is on the wall. Many PTs have identified with the opportunities available in the onsite industrial and business setting. It is through ergonomics and the management of workers' compensation claims that they are entering this segment of the marketplace and thriving.

SEARCHING FOR NEW HORIZONS: THE PT AS ERGONOMIST

Let us first define ergonomics. The Board of Certification in Professional Ergonomics (BCPE) defines ergonomics as a body of knowledge about human abilities, human limitations, and other human characteristics that are relevant to design.[6] Literally, it means "the laws of work," incorporating human function with the design of tools, machines, systems, tasks, jobs, and environments for safe, comfortable, and effective human use.

Over the last decade, ergonomics has gained significant popularity with health care professionals, particularly physical therapists. Ergonomics and Human Factors Engineering is projected to grow 14% to 19% in the next 10 years.[5] A few of these professionals began as physical therapists. According to the BCPE, there were approximately 74 Board Certified Ergonomists with either a Physical or Occupational Therapy degree in 2009. As of July 2007, the Oxford Research Institute has certified 407 Industrial Ergonomists and/ or Human Factors Engineers, many of whom are physical therapists.[7] Needless to say, the job market is robust for entry into this field. Whether you pursue a degree in Human Factors and Ergonomics Engineering, participate in continuing education programs sponsored through leading universities and other courses, or benefit from reading the literature and gaining practical onsite ergonomics experience, all are essential ways to making the transition to becoming an ergonomics practitioner. The Physical Therapist has a great advantage possessing key knowledge and skills to perform ergonomic worksite analysis, provide employee training and to develop critical control measures to reduce ergonomic risk factors. These are all critical factors in helping employers reduce the risk of work related musculoskeletal strains and sprains.

WHAT ARE YOUR OPTIONS?

Developing yourself into an ergonomics practitioner takes time and dedication beyond a one day or one week workshop or participating in the onsite hospital ergonomics and safety team. It takes the integration of all your skills, knowledge, and desire to learn about the American worker as well as business and industry over a period of years. Commitment to the practice of ergonomics and respecting the last 60 years of research that dedicated human factors and ergonomics practitioners have forged is also essential.

The last decade has recognized the pursuit of ergonomics as a career by more than just engineers and industrial psychologists and as such, a well defined pool of certifying entities has developed outside the traditional university. There are now a range of private label and board certified programs available to the physical therapist. Deciding which to pursue is a matter of a personal choice, understanding the criteria that each offers. Professional boards provide a more formal organization with procedures for examining and certifying qualified practioners of ergonomics and are supported by multiple professionals with credentials serving on a board of directors. The two national boards that exist today to certify Human Factors and Ergonomics professionals are the Board of Certification in Professional Ergonomics, BCPE (www.bcpe.org) and the Oxford Research Institute, ORI (www.oxfordresearch.org).

The BCPE is governed by an elected board of leading professionals and is managed by an Executive Administrator and a Financial/Information Systems Manager. The BCPE is endorsed by the IEA, the International Ergonomics Asso-

ciation, as an accredited ergonomics certifying body and is a corporate member of NOCA, the National Organization for Competency Assurance. The ORI has established a rigorous process for certification based upon a controlled peer review process. The Oxford Research Institute is a nonprofit, ergonomics Safety Corporation within the State of Maryland and is managed by a board of directors and an executive director.

In contrast are the "private label" entities. These are most often provided through a privately owned corporation, not necessarily supported by a recognized national board. In general, you pay a fee to attend the class, meet selected requirements established by the company, and receive a certification as an ergonomic specialist or other designation determined by the company. There is no peer review process or exam to pass in most cases. These workshops generally are offered as a 2 to 5 day program. "Private label" programs include the Ergonomic Evaluation Certification Program by Roy Matheson, CEES[8] and the Back School of Atlanta by Ron Porter, PT, CEAS.[9] In some cases, the PT must submit proof of completion of criteria defined by the course in order to obtain the certification. As a result, the standard of knowledge, experience, and skill obtained through these avenues varies significantly. There are also one or two day ergonomics seminars available where you receive a certificate of participation or completion. These can offer you the confidence to call yourself an "ergonomics specialist" with a little time and experience put in to work with what you learned. But they won't make you a certified ergonomist.

The table below identifies the "private label" and board certified ergonomics programs available in today's marketplace and the certification provided by each group. The table does not include human factors certifications or human factors and engineering degree programs available through universities and colleges. Those listed below typically require a passing grade on a proctored exam and/or submission of work and letters of recommendation from qualified ergonomists to support your application.

HOW ARE YOU GOING TO GET THE NECESSARY QUALIFICATIONS?

Gaining the necessary experience to become qualified in Ergonomics is difficult. It takes substantial time and effort to not only get the onsite work experience, but to accomplish the reporting sufficient to achieve the credentials. Each entity has set a minimum level of competency beyond the typical core curriculum of the physical therapist.

When the Occupational Injury Prevention and Rehabilitation Society (OIPRS) was active, it supported the credentialing of PTs through BCPE and ORI, but did not feel their established criteria should be the only criteria necessary to become an ergonomic specialist.[10] The OIPRS identified a minimum level of skill and knowledge in providing MSD treatment, analysis, and other ergonomic related services. In their position statement, in response to the Fed OSHA Standard, the following criteria were identified:

1. A minimum of 40 hours of continuing education specific to performing ergonomic analysis and the identification and treatment of MSDs.
2. A minimum of 40 hours of experience in the field performing ergonomic analysis and the identification and treatment of MSD.
3. Ability to implement a multi-level ergonomic and occupational health plan including, employee and management, education, ergonomic analysis and evaluation, MSD identification, and management.
4. Basic knowledge of statistics and engineering as well as business processes such as production inventory, workers' compensation, and unionized work settings.
5. Knowledge of human resources policies and governmental regulations such as OSHA, EEOC, and ADA.

The other certifying boards and private label entities have each established their own minimal criteria with significant variability. This is particularly noted with private label programs that require little to no experience, provided you have the money for the course. Whereas, the BCPE and ORI require a BS degree or higher and at least 3 to 6 years experience relevant to qualify for their CPE or CIE certifications, respectively. To learn more about the required criteria, visit the Web sites noted in this article. Nonetheless, to move into the field, PTs are best advised to acquire the necessary skills through continuing education courses, on the job training, and mentoring. Pursuing board certification at some level will demonstrate

Table 1. Ergonomic Certification Options for Physical Therapists

Name	Type	Address	Phone	Certification/Years F/T Experience
Board of Certification in Professional Ergonomics	National Board Certification	P.O. Box 2811 Bellingham, WA 98227-2811	Phone: (360) 671-7601 Fax: (360) 671-7681 www.bcpe.org	CPE - Certified Professional Ergonomist/3 yrs AEP - Associate Ergonomics Professional/3 yrs CEA - Certified Ergonomics Associate/2 yrs
Oxford Research Institute (ORI) Attn: William Banks	National Board Certification	10153 Vantage Point Ct. New Market, MD 21774	Phone: (301) 865-4506 Fax: (301)524-3895 www.oxfordresearch.org	CIE - Certified Industrial Ergonomist/4-6 yrs CAE - Certified Associate Ergonomist/ not specified
Ergonomic Evaluation Certification Program Roy Matheson & Associates	Private Label Certification	P.O. Box 492 Keene, NH 03431-0492	Phone: (800) 443-7690 Fax: (603) 358-0116 www.roymatheson.com	CEES - Certified Ergonomic Evaluation Specialist/not specified
Back School of Atlanta Ron Porter PT, Director	Private Label Certification	1962 Northside Dr. Atlanta, GA 30318	Phone: (800) 783-7536 Phone: (404) 355-7756 Fax: 404-355-3907 www.backschoolofatlanta.com	CEAS - Certified Ergonomic Assessment Specialist; 3 levels offered/CEUs provided

to regulators, employers, insurers, physicians, and practicing ergonomists and human factors professionals a quality level of competency to practice ergonomics that will assure the PTs place in the professional field of Ergonomics.

ESTABLISHING AN ERGONOMICS SERVICE LINE IN THE CLINIC

Once you are certified and credentialed in ergonomics, one of the best ways to begin an ergonomics business for your clinic is to offer an array of ergonomics services. The typical outpatient orthopaedic clinic offers immediate access to perfect clients who will benefit from ergonomics services, injured workers, and their employers. Workers' compensation patients tell the story of what is happening at the workplace, making it an excellent opportunity for the PT Ergonomist to offer their services to the employer, the insurance company, and the primary treating physician on the case. An opportunity to go onsite to reveal to all parties involved how the injury can be prevented from happening again and how to manage the current injury more effectively is priceless. The PT Ergonomist is in the position to do all that. The following is a list of a few typical services that one could offer:

- Ergonomic Worksite Analysis for injury prevention, management, and disability management
- Onsite office ergonomic chair assessments and fittings
- Alternative ergonomic keyboard and mouse trials with instructions on proper mechanics
- Ergonomics training for office or industrial employees
- Body mechanics and posture awareness

WHAT TO CHARGE

It is important to charge an appropriate rate that is based on your experience as an ergonomics consultant and what the market will bear based on your community economics. If you have no experience, begin with providing some complimentary in-services for your local chamber of commerce to gain interest. Do a few walk-throughs for local businesses and discuss with the HR Manager, Safety or Risk Manager the issues they have with work injuries. As you go along, discuss what you observe as potential ergonomic risk factors, etc. Provide value along the way. Keep in mind that you will likely need to charge less in a small town than the big city. In general, consulting service fees range from $100-$150/hour and increase with experience. If you are providing ergonomic analysis as part of a workers' compensation injury case, be sure to have a physician prescription for the service, get your services authorized in advance with the adjuster, and discuss the payment process up front. The employer benefits from this service as part of the medical management of the claim without having to put their own dollars out, and that is very favorable for the PT Ergonomist and future business. The employer receives significant benefits from the ergonomic analysis that not only impacts the injured worker, but other workers performing the same job.

TRACK YOUR SUCCESS

As you gain experience over time, track your successes with your clients. Be objective and provide evidence based reporting to your clients to support your recommendations. Provide practical and valuable solutions that are easy to understand and implement in a written report. Most importantly, follow up to determine if your results were effective and helpful for all parties involved. This will help to propagate your ergonomics business.

PT AS ERGONOMIST

Choosing to pursue ergonomics as an adjunct to your current PT practice or making the transition entirely to PT Ergonomist or specialist will afford significant opportunity for the PT in the 21st century. Becoming a PT Ergonomic Specialist is more than just being able to perform an office ergonomic analysis or return an injured worker back to work with the installation of a keyboard tray. It takes dedication to learning how to integrate the theory and practice of ergonomics into who we are as a profession and validating our work in the field to those who have gone before us.

In this marketplace, there are currently no capitations, no CPT or RVS codes. A dollar billed is a dollar received. There are no HMO rules restricting the delivery of the service, only the desire of the employer and insurer to do the right thing for the (injured) worker and to preserve safety in the workplace. Here, the PT Ergonomist can make substantial and significant impact no longer patient-by-patient but by impacting an entire workforce over time with ergonomics skills and savvy as well as our traditional methods of care, forever changing the way health care is delivered in this century.

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PERFORMING ARTS

SPECIAL INTEREST GROUP

FALL GREETINGS!

Things are coming full circle for me. I joined the PASIG Board in 2005 when CSM was in New Orleans. This coming CSM 2011 will again be in New Orleans and it will be my last CSM as PASIG President. Many events have transpired in these past 6 years around the world and in our country including Hurricane Katrina, the economic recession, the Haiti earthquake, the Gulf oil spill, the Pakistan flooding, and the health care reform bill. Personally, I have become a clinic owner and the mother of two little boys. This fall and winter, I reflect on how I have learned from these life experiences.

I hope many of you will join us in New Orleans for CSM 2011 on February 9-12, 2011. The PASIG Programming is "Movement Impairment Issues in Performing Artists: Considerations for Evaluation and Treatment of Upper and Lower Quarter Injuries." The keynote speaker is Lynette Khoo-Summers from Washington University with cases being presented on vocal musicians, instrumental musicians, dancers, and figure skaters. Also, please plan to attend the PASIG business meeting, which is open to all members and nonmembers.

The deadline for the **PASIG Student Research Scholarship** is approaching. The scholarship is a $400 award to defray the cost of presenting your performing arts research at CSM. Research must have been conducted while a student and your abstract should have already been accepted to CSM 2011. Submit your abstracts by November 15 to Amy Humphrey at AHumphrey@bodydynamicsinc.com. More details can be found on our Web site: https://www.orthopt.org/sig_pa.php.

Have you used the new directory search? It is much more powerful than the old one. You can now search for a PASIG member by city, state, performing arts specialty, clinical affiliation, and more. However, if you haven't updated your profile, then your information cannot be found. It only takes **5 minutes** to update your PASIG Membership Profile on the Web site: https://www.orthopt.org/sig_pa.php. You must enter your password, then click on the link on the right hand side that says **"PASIG Member Profile Update."**

This November, the PASIG will be electing a new President and a Nominating Committee member. Please look for the ballots and **VOTE** during the Orthopaedic Section elections.

Finally, in this newsletter, you will read a performing arts case study regarding rehabilitating a dancer with hip and knee pain. If you have an interesting PA case study or project that you would like to have published, please contact Lisa Shoaf at lshoaf@vcu.edu. The PASIG is striving to contribute to the PA evidence based body of knowledge, and we have members who can help you through the process.

Yours in the arts,
Leigh A. Roberts, PT, DPT, OCS

REHABILITATION OF AN ADOLESCENT DANCER WITH SNAPPING HIP SYNDROME AND PATELLOFEMORAL PAIN

Leigh A. Roberts, PT, DPT, OCS
Lisa Donegan Shoaf, PT, DPT, PhD

INTRODUCTION

Hip and knee injuries in dancers may account for 6% to 40% of lower extremity injuries.[1-4] In the hip, painful snapping hips were the most frequent complaint with a frequency as high as 43.8% reported by Reid.[1,5] In the knee, peripatellar knee pain was the most common complaint, accounting for greater than 50% of the problems.[1,5]

Snapping hips may be described as external due to the iliotibial band (ITB) snapping over the greater trochanter, or as internal due to the iliopsoas tendon snapping over the iliopectineal eminence, femoral head, or lesser trochanter.[6] Winston reports that 91% of dancers, age 16 and older, self-reported snapping hip.[6] Ultrasound showed 59% of these dancers had internal snapping hip while 4% had external snapping hip.[6]

Patellofemoral pain (PFP) has been found to be related to altered hip and trunk muscle functioning.[7,8] Others suggest that functioning of the vastus medialis obliquus (VMO) may contribute to PFP.[7,9] This case was selected because it supports the recent research that improving lower extremity (LE) kinematics, and not strengthening alone, is important to the rehabilitation of patients with PFP. The purpose of this case is to describe the rehabilitation course of an adolescent dancer with hip and knee pain.

INITIAL EXAMINATION/EVALUATION

The subject of this case study is a 16-year-old female recreational dancer referred from a sports medicine physician for right knee patellar subluxation and right hip snapping. The patient reported a gradual increase in pain beginning in September prior to the start of physical therapy in January 2009. She had a history of recurrent dislocation of the right knee, with the first incident occurring 3 years ago. At the time of the evaluation, she reported that she had not had an occurrence of patellar subluxation in 5 to 6 months.

At initial evaluation the patient reported she had experienced hip pain during the Nutcracker Season of November and December, but her hip pain had improved since she had not been dancing, and was currently 0/10 on the Numerical Analog Scale (NAS). Therefore, initial evaluation focused primarily on her knees. The patient's chief complaint was intermittent right knee pain, with pain 4/10 that day and 8/10 at the worst with sitting, stairs, and squatting. The patient was not dancing due to the knee pain, so her goal was to resume pain free dancing. Under normal conditions, she danced at her high school daily for 50 minutes of modern and jazz, and at a local studio 3 times per week for 60 to 120 minutes of ballet and tap.

On examination of posture in standing, a prominent bilateral genu valgum and bilateral genu recurvatum, as well as

Table 1. Strength Testing Using 5 Repetitions of Manual Resistance through the Range

	Initial Evaluation January 2009		May 2009		Discharge July 2009	
Muscle	**Right**	**Left**	**Right**	**Left**	**Right**	**Left**
Hip Flexion	3	4	4	4	4	5
Hip Extension	4	4	4	3	4	4
Hip Abduction	4	4	4 pain	4	4	4
Hip Adduction	3	4	4 pain	3	4	4
Hip External Rotation	3	4	4	4	NT	NT
Hip Internal Rotation	4	4	4	4	NT	NT
Knee Flexion	4	5	4	4	NT	NT
Knee Extension	4	4	5	5	5	5
Terminal Knee Extension	NT	NT	3	4	4	4

externally rotated right foot with increased right foot pronation compared to the left were observed. The patient was tender to palpation at the infero-lateral patella with hypermobility in bilateral patella in all directions. She had full active range of motion (AROM) in bilateral knees with lateral tracking of the patella by visual observation. Her strength findings were weaker on the right, especially for hip flexion, hip adduction, hip external rotation, and knee flexion (Table 1).

Flexibility ranged between normal to hypermobile throughout bilateral lower extremities (LE). Lachman's test to the right knee was slightly positive though she did not report any giving way. She demonstrated poor lower extremity alignment during a half-squat (parallel plié) with her knee tracking medially over her foot (valgus force). Proprioception was assessed by timing the patient's performance of single leg balance. She was able to balance on single leg with eyes open for 30 seconds but had increased wobbling with the eyes closed trial. Her performance on single-leg balance with eyes closed was 6 seconds on the right and 15 seconds on the left. Additionally, the patient wore athletic shoes with poor arch support. The clinical hypothesis after the initial evaluation was "patellofemoral pain due to right LE weakness and right foot pronation."

INITIAL TREATMENT PLAN

Initial treatment was impairment-based including: (1) off-the-shelf (OTS) arch supports, (2) a home exercise program (HEP) of weight bearing and nonweight bearing strengthening exercises, and (3) massage to the ITB. The HEP included quad sets, straight leg raises, sidelying hip abduction/hip adduction, wall slides, bridging with adduction and single leg balance/proprioception activities. Proprioception exercises were included early in the rehabilitation given that individuals with PFP have demonstrated abnormal proprioception.[10]

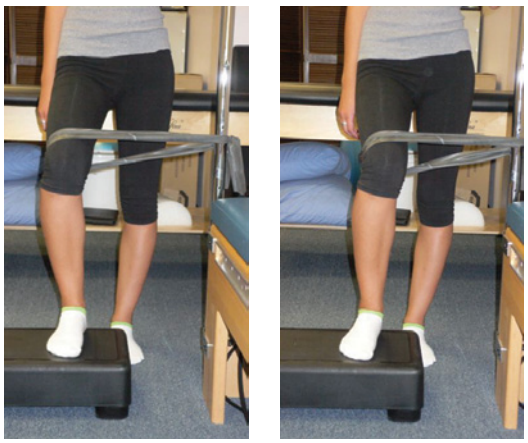
Taping techniques were also used early in treatment until it was discovered that the patient had an allergy to latex. The therapist felt that strength was the biggest impairment and the patient was compliant with her HEP; therefore, visits were scheduled 2 to 3 weeks apart.

By the fifth visit in March, the patient reported knee pain 2/10 that day and 4/10 at the worst. She had returned to performing jumps in every ballet class. However, her hip pain had returned. The therapist observed the patient in the symptomatic action of single leg squat (plié) in parallel. This action revealed knee valgus force with femoral adduction. This kinematic description has been reported frequently in the literature in relation to PFP. Bolgla found that while hip abductor and external rotator weakness was present in subjects with patellofemoral pain, they did not necessarily demonstrate altered kinematics (including hip internal rotation, hip adduction, and knee valgus) during stair descent.[11] Similarly, Willson showed that while women with PFP do have weakness and altered LE kinematics, these two metrics do not highly correlate during jumping.[12] Mizner showed that an instructional session can improve the landing kinematics of collegiate athletes and muscular strength was a poor predictor of the landing patterns.[13] At this time, the focus of treatment changed from strengthening to neuromuscular control of the lower extremity during dynamic activities.

Also on visit 5, the therapist performed a foot evaluation to screen for foot structural defects as a contributing factor to the patient's complaints; custom orthotics were not recommended and patient was advised to continue with OTS arch supports.

The next visit (visit 6) was one month later, due to limitations in the patient's schedule. She reported that the right knee was 'okay' but the right hip was painful (4/10 that day and 6/10 at the worst) with stairs (pops on ascending), grande plié, and jumping. Based on assessment findings, the therapist's clinical hypothesis was a 'muscle strain to the hip rotators.' The therapist recommended stopping all exercises due to the patient's acute status; the patient initiated RICE including resting from all painful activities, icing 3 times daily, and wrapping the thigh for support.

On follow up one week later, while the patient reported less pain overall, ironically, her NAS scores did not change. She reported she had to go up and down a lot of stairs at school and this reproduced her pain. She also had stopped performing



Photos 1 and 2. Step-up exercise to re-educate proper alignment of the LE and increase firing of gluteus medius (a) correct alignment (b) incorrect alignment.

grande pliés and jumps in ballet class secondary to hip pain. Treatment focused on soft tissue massage to the hip rotators and ITB, and a HEP of stretching for hip external rotators and ITB, although strengthening was not yet resumed. The therapist provided the patient with a note so that she could use the elevator instead of the stairs at school.

Three weeks later in May (visit 8), the patient reported hip pain 1/10 that day and 3/10 at the worst, however, her knee pain increased to 4/10 that day and 5-6/10 at the worst. She reported that using the elevator helped the hip and she was compliant with a HEP of stretching. Strength was reassessed (see Table 1) which revealed improvement in strength since initial evaluation throughout the right LE except for weakness on the right side for terminal knee extension and pain with hip abduction/adduction, and weakness in the left gluteal and adductor muscles.

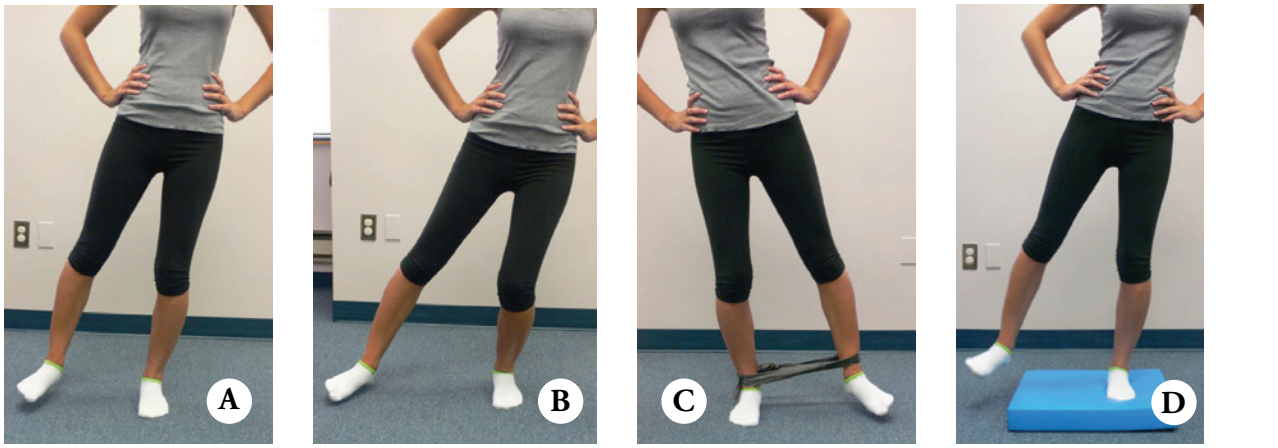
The patient continued to complain of hip pain related to popping of her ITB when the knee was flexed. The clinical hypothesis at this time was 'decreased LE strength/endurance and poor LE alignment during single-leg squat.' The therapist recommended increasing physical therapy visits to twice weekly for strengthening and re-education of LE alignment during functional and dynamic activities.

ADDITIONAL MODIFICATIONS TO TREATMENT PLAN

Visits 9 through 16 occurred over 7 weeks from May until early July. The focus was to improve the patient's LE kinematics and complaints of painful hip snapping, especially on stairs. The literature has demonstrated that patients with anterior knee pain have delayed onset and shorter duration of contraction of gluteus medius while ascending and descending stairs.[14] On this visit, the patient was unable to perform a step up without experiencing hip popping. The popping was reduced with hip abduction, so the therapist placed a resistance band loop just superior to the knee to perform the exercise (Photos 1& 2) and the patient was given this as a HEP. By the next visit, the patient was able to control the popping and did not require the band. Souza used magnetic resonance imaging (MRI) to study the kinematics of females with and without PFP; the results suggest that altered kinematics in females with PFP are related to excessive medial femoral rotation, not lateral patellar rotation.[15]

Proprioception exercises that were initiated early in treatment were progressed from static single leg exercises to dynamic single leg exercise with increased proprioceptive challenge (see Photos 3-6). The exercise chosen was based on the Star Excursion Balance Test (SEBT), which has been shown in the literature to be a reliable way of measuring balance.[16] The therapist in this case study did not quantify (or measure) the patient's excursion, however, used it as a treatment to challenge the patient because the SEBT activities are similar to activities that are performed in a ballet class (ie, tendu, dégagé). Thorpe compared female collegiate soccer athletes with non-athletes and found that strength was not highly correlated with a good score on the SEBT.[17]

Jumping activities in a gravity-eliminated position on the Reformer were initiated on visit 12 (Photo 7). In this posi-

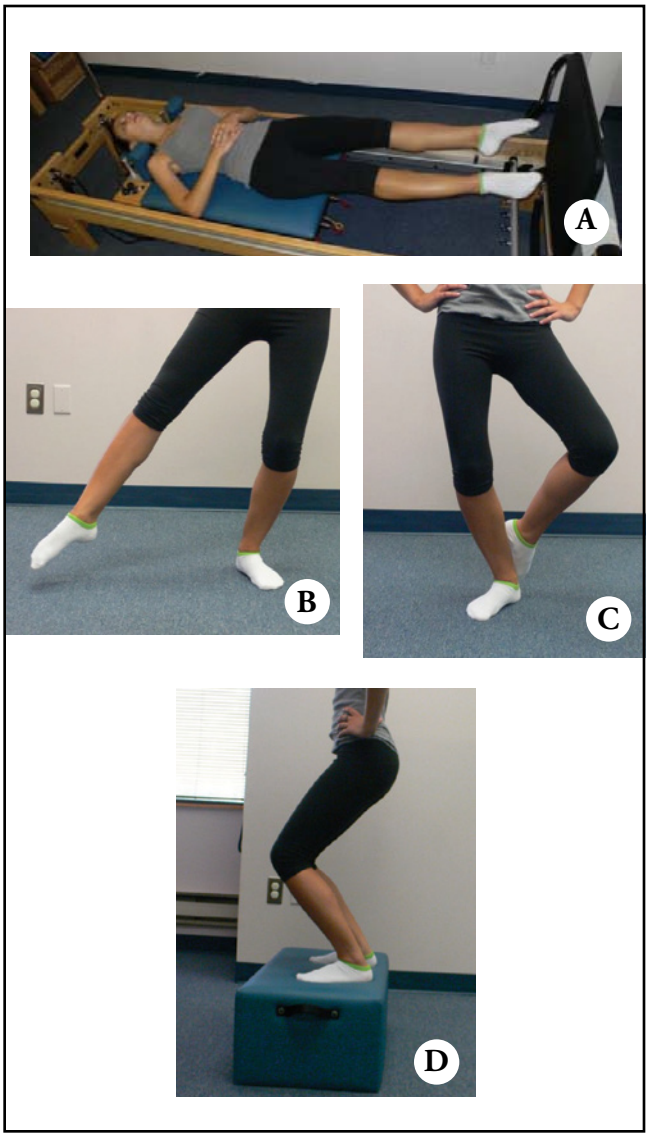


Photos 3-6 demonstrate a progression of the Star Exercise that progressively gets more difficult (A) static standing leg (B) add dynamic motion (plié on standing leg), (C) add Thera-Band resistance, and (D) add proprioception challenge.

tion, the weight bearing forces were reduced and the patient could focus on avoiding a knee valgus moment during landing. Once the patient demonstrated good alignment and no pain on the Reformer, the jumps were progressed to full body weight on the floor with dance specific jumps (Photos 8 and 9). To further challenge the patient, plyometric exercises jumping on and off of a box (Photo 10) were added on visit 15. A rehabilitation progression of jumping for dancers is described in Table 2.

CONCLUSION

This adolescent dancer received 16 physical therapy visits over a 6-month time period for treatment of knee and hip pain. Initially, the patient received a limited number of visits with an emphasis on the home program between visits; however, this resulted in only partial resolution of knee symptoms and a return of the patient's hip pain that further limited her dancing. This prompted several changes in the plan of care, including increasing the frequency of physical therapy visits. Once the lower extremity kinematic alignment issues were addressed, as well as reducing the non-dance stresses of stair climbing, the patient's symptoms resolved in 7 weeks and she was able to return to full pain-free dancing. Despite the patient's compliance with the home program and all physical therapy recommendations, it was necessary to provide more one-on-one treatment for this patient that addressed symptom management, kinematic corrections, recognition of other contributing activities, and progressive return to dance activities.



Photos 7-10 demonstrate jumping progression (A) gravity-eliminated on the Reformer with two legs turned-out in first position (B) & (C) one leg to one leg jumping on the floor (jeté), and (D) plyometric jumping on the box.

Table 2. Jumping Progression (dance application)

- Pilates Reformer
  - Double Leg (saute parallel, turned out)
  - Push off from 1 foot/land on 2 feet (1➞ 2)
  - Push-off from 2 feet/land 1 foot (2 ➞ 1)
  - Single Leg (temps levé (hopping) parallel, turned out)
- Floor
  - Double Leg (1st position, 2nd position)
  - Push off from 1 foot/land on 2 feet (1➞ 2) (assemble)
  - Push-off from 2 feet/land 1 foot (2 ➞ 1) (sissonne)
  - Single Leg (jeté (changes feet))
- Plyometric on / off box
  - Double Leg
  - Push off from 1 foot / land on 2 feet (1➞ 2)
  - Push-off from 2 feet / land 1 foot (2 ➞ 1)
  - Single Leg

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PLAN TO ATTEND THESE FUTURE APTA NATIONAL MEETINGS

National Student Conclave
Oct 29-31, 2010
Cherry Hill, NJ

CSM 2011
February 9-12, 2011
New Orleans, LA

Annual Conference: PT 2011
June 8-11, 2011
National Harbor, MD

SPECIAL INTEREST GROUP

PRESIDENT'S MESSAGE

FACIAL PAIN AND PHYSICAL THERAPY

This past summer I seem to have had more patients with non-TMJ facial pain than ever before. One of my patients, who also happens to be on the Board of Directors of the Facial Pain Association, gave me an extremely helpful book that summarizes the diagnosis and treatments of all types of facial pain. The book is, *"Striking Back! The Trigeminal Neuralgia and Face Handbook"* by George Weigel and Kenneth Casey, MD. The book is written as a layman's guide to understanding and treating facial pain, but is a good general reference for anyone who sees facial pain. I found the most useful parts to be the clues to possible diagnosis, the many faces of face pain describing 33 conditions that can cause facial pain, and the comparison of medications used to treat facial pain, their side effects, and interactions. There are many chapters describing the good, bad, and ugly of the surgical techniques used for Trigeminal Neuralgia (TN) as well as nonsurgical therapies. The therapies are described in an informative nonjudgmental way with mention of research to support and refute their effectiveness.

My major disappointment was that physical therapy was not mentioned in the nonsurgical approaches to facial pain. Joint mobilization/manipulation, CAM supplements, Craniosacral therapy, TENS, laser, etc. are described but not with a mention of using a physical therapist for pain control. A few people in the facial pain support groups have used physical therapy with mixed results as it appeared that some of the physical therapists used were not familiar with pain management.

The Facial Pain Association (formerly the Trigeminal Neuralgia Association) has a wealth of information for professionals and support groups for patients. If you or a patient needs information about facial pain, visit http://www.fpa-support.org.

We are slowly moving forward with our goal of having a series of home study modules leading to certification in pain management. Please let me know if you have any ideas or topics that you would like to see covered or suggestions for content writers. Presently, ideas for topics are: Basic Neurosciences, Life Span, Fibromyalgia, CRPS, Central Pain/Sensitivity Syndromes, Arthritis, Pediatric Pain, Psycho-Social Aspects, and Wound Pain.

Congratulations go to Marie Hoeger Bement who gave birth to twins this past May.

This is an election year for PMSIG officers; open offices include President and Vice President. I encourage all members to return your ballot before November 30th.

Have a great fall.

John Garzione, PT, DPT, DAAPM
President

ANIMAL REHABILITATION

SPECIAL INTEREST GROUP

EDUCATIONAL NEWS

The 6th annual International Association of Veterinary Rehabilitation and Physical Therapy (IAVRPT) conference was recently held August 4-7th at Auburn University, in Auburn, AL. Wednesday was devoted to preconference "hands-on" courses, followed by a wine/cheese reception.

The Thursday morning session included both the equine and canine practitioners, and the talks were centered on regenerative medicine, including the use of stem and progenitor cells, to aid in healing of damaged or injured tissues. In the afternoon, the equine and canine practitioners split up for talks related to their particular species of interest.

On Friday, the groups convened for discussions regarding the importance of evidence-based medicine and legislative issues facing practitioners in the animal rehabilitation field. Representatives of the IAVRPT, the AARV (American Association of Rehabilitation Veterinarians) and our own Animal Rehab SIG spoke briefly about their respective organizations, membership, and the goals of each group. It was very informative for all the participants, and an underlying theme expressed by each group was their interest in collaborating with other professionals in order to provide high quality care to their animal patients. The afternoon sessions were again split between equine and canine talks. New to this year's symposium was a more "basic" track of programming for those recently entering the field, and a more "advanced" track for those practitioners who have been performing hands-on treatment for awhile. Friday night was "Gala Night," where all the participants could network and enjoy an evening of live music, hors d'oeuvres, and good companionship.

On Saturday, the theme focused on "How I Treat," where speakers gave their rationale for treating different neurologic and orthopaedic cases. In the afternoon, awards were presented for the best research podium and poster presentations, and closing remarks were given by the new IAVRPT President, May Romer.

In all, it was well-attended, with over 250 participants from 14 different countries represented. There was also good representation from the vendors, both with educational resources as well as equipment and supplies. The next IAVRPT conference will be held in 2012, and will most likely be overseas. At the time of this writing, there had been applications put in to host from facilities in Italy and Austria, so start saving and get your passport!

LEGISLATIVE UPDATES

New Hampshire: House bill 1525 went into effect July 1st. It allows physical therapists who have met the requirements to register under the state Veterinary board as an "Animal Physical Therapist" in order to practice with animals.

Nebraska: There is a veterinary board meeting 8/17/10 to discuss finalizing the rules and regulations in the draft proposal that would allow other practitioners such as physical therapists and chiropractors to register with the veterinary board upon completing the competency requirements. If the rules and regulations are finalized, then it will be submitted for a public hearing.

California: There was recently a motion made to restrict the ability of physical therapists to treat animals in the state, but practitioners successfully lobbied to have the motion come to a public hearing, where further input can be given to lawmakers about the qualifications that PTs have in order to work collaboratively with veterinarians.

ARSIG BUSINESS MEETING

6th International Symposium on Veterinary Rehabilitation & Physical Therapy
August 7, 2010

AGENDA
Updates

- Updates:
  - Practice Analysis – in progress
  - Model language
    - Received transcript from legislative meeting on 8/3/10
    - Draft reviewed by Ortho Section BOD; distributed to membership for review
    - Sign up to receive a draft for review: tfred@orthopt.org
    - Discuss w/ AARV
      - > Legislative support from veterinarians/ AARV – letters/statement from AAR in support of PTs doing rehab
  - CSM 2011: New Orleans
    - Dr. Jan Van Dyke
      - > Veterinary Zoonoses, What You Need to Know Before You Treat That Puppy!
      - > Veterinary Red Flags, Endocrine, Metabolic, and Medical Syndromes That Might Be Lurking in Your Canine Rehab Patient
- Tasks:
  - Clinical coordinator educational resources for PTs (C. Riegger-Krugh)
  - Third Party Payment Resources (D. Rogers)
  - Liaison Coordinator (C. Evans)
    - Within the AARV, develop a co-existing veterinary liaison in each state to work side by side with each PT liaison
  - Newsletter (L. Bedenbaugh)
    - Read for credit – being investigated with Ortho Section board
    - Send publications to Lisa: lhinerman2@aol.com; we always need material!

- Residency/Education **(need member volunteers)**
  - Advanced courses – possibly include vets, depending on what type of course it is
- Member resources **(need member volunteers)**
  - Clipboard – okay for Jennifer to get started on this; Carrie to send her a copy of the canine board
  - Exercise cards (combine efforts from practicing PTs around the country)
  - Home care programs, handouts, etc. – compile from practicing PTs around the country to avoid 'reinventing the wheel'
  - Legislative efforts
    - Links to legislative documents, model language (once approved), how to approach vet/PT boards, etc.
  - Ideas?
    - Combine efforts with AARV for newsletter submissions – case studies, what is a PT?, etc.
    - 'Find a PT' on AARV website / 'Find a vet' on SIG website to encourage/promote collaboration and mentorships
    - Powerpoint / document for members to 'borrow' to educate their local veterinarian – "who we are, what we do" [Amie to draft a letter for AARV, per Jan Van Dyke]
- AARV collaboration – items for discussion:
  - Co-host meeting at NAVC/CSM – have an 'all association' meeting – collaborative discussions addressing a variety of legislative topics, policies, position statements
  - 15 hours CE each year – AARV needs to consider that not all states may recognize animal CEs. many states need 30 'human' CEs, and an additional 15 CEs/year is not feasible geographically and/or financially, as well as acquiring 'time off' to attend these courses
  - Consideration: PTs may get slammed with registration fees if they want to attend different veterinary conferences; one vet stated they also have the high registration fees if they are not members (but PTs cannot be members of many vet organizations)
    - VOS has a reasonable membership fee ($25) – many different professionals may join
  - List members geographically to develop reciprocal mentorship program / cross training
  - Vets support PT legislative efforts
    - Does AARV have direct communication with VMAs and Vet Boards? Send support letter to them on behalf of AARV
- Competencies – document is complete (first draft); update and distribute to membership for review
- Open discussion

The task list continues to grow and we need your help! Please contact Amie or Carrie if you are interested in joining one of the above task forces.

Orthopaedic Physical Therapy Practice

Instructions to Authors

Christopher J. Hughes, PT, PhD, OCS, Editor
Sharon L. Klinski, Managing Editor

1. *Orthopaedic Physical Therapy Practice (OPTP)* serves as a publication option for articles pertaining to clinical practice as well as governance of the orthopaedic section and corresponding Special Interest Groups (SIG). Articles describing treatment techniques as well as case studies, small sample studies and reviews of literature are acceptable. Papers on new and innovative technologies will also be considered for publication. Language and format of articles should be consistent with the *Guide to Physical Therapist Practice*. SIG authors must adhere to the 12 page limit when submitting articles as part of SIG report.

2. Manuscripts should be reports of personal experiences and written as such. Though suggested reading lists are welcomed, references should otherwise be kept to a minimum with the exception of reviews of literature. All authors are required to sign a consent form indicating verification of original work and this form must accompany your work at the time of submission. This form can be found on the Orthopaedic section website (www.orthopt.org) under the Orthopaedic Physical Therapy Practice link. Authors are solely responsible for proper citation of work and avoiding any issues with copyright infringement related to writing or use of images or figures. For more information on plagiarism authors may find the following resources helpful:
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3. Presenting research: OPTP welcomes traditional experimental research studies as well as case reports. Studies involving human subjects must have successfully met the requirements and been approved through an institutional review board. Case reports of involving 3 or less subjects must follow HIPAA guidelines in protecting the privacy of subjects. For more information access the following:
http://www.hhs.gov/ocr/hipaa/

4. **Article Review Process**
Authors will be immediately notified of receipt of document by managing editor. All initial reviews are done by the editor, managing editor, and also possibly a member of the advisory council of OP. A schematic of the review process is attached. Articles are reviewed in the order in which they are received. You will receive a confirmation of your submission and will be updated on the status of your work as we complete the review process. A schematic of the review process is attached.

5. **Manuscript Preparation Guidelines**
Title Page - include the author's name, degree, title, current place of work or affiliation, corresponding address, phone and FAX numbers, and email address.

Abstract - Abstract of 150 words or less using double space format. Abstracts at minimum should include the following headings: Background and Purpose, Methods, Findings, Clinical Relevance
Key words should also be listed after the abstract.

Format - text should be a minimum of 12 pages double-spaced, use a 12-point font; margins should be 1 inch on each side. Headings should be formatted as follows:
MAIN HEADING
Secondary Heading
Tertiary heading

Citation of Reference List - references should be numbered sequentially as they appear in the text and should correspond to the superscript number in the text. Do not repeat the same reference using a different number in the reference list. Only references cited in the paper should be listed.

Journal Articles

16. Ferguson CT, Cherniack RM. Current concepts: management of COPD. *N Engl J Med*. 1993;328:1017-1022.
17. Rueben DB, Siu AL. An objective measure of physical function of elderly outpatients (The Physical Performance Test). *J Am Geriatri Soc*. 990;38:1105-1112.

Books

18. Steindler A. *Kinesiology of the Human Body Under Normal and Pathological Conditions*. Springfield, Ill: Charles C. Thomas; 1995:63-64.

Abbreviate United States state and territory names as specified in the *American Medical Association Manual of Style*—NOT according to the United States Postal Service abbreviations.

Editor(s) as author:

19. Scully RM, Barnes ML, eds. *Physical Therapy*. Philadelphia, Pa: JB Lippincott Co; 1989:83-98.

Reference to part of a book:

20. Goodman CC. The endocrine and metabolic systems. IN: Goodman CC, Boissonault WG, eds. *Pathology: Implications for the Physical Therapist*. Philadelphia, Pa: WB Saunders; 1997.

Tables - provide tables to present information more clearly and concisely than if presented in the text. Table titles are usually written as phrases. They are capitalized in title case and do not employ terminal punctuation:

Table 1. Symptoms of Chronic Fatigue Syndrome

Reference to a Web site:
Information on Total Knee Replacements. American Academy of Orthopedic Surgeons. www.aaos.org/wordhtml/research/oainfo/OAinfo_knee_state. Accessed on September 5, 2005.

Format and Presentation of Figures, Graphics, and Tables

Figures and Graphics:

- Figures should be submitted as separate, high-resolution graphic files in TIF, JPG, EPS, or PDF format, with the resolution set at a minimum of 300 dpi. Rule of thumb: the larger the figure (eg, 8 1/2" x 11"), the better. Figures – prepare as 5 x 7 black and white photographs, camera-ready artwork (eg, line drawings and graphs), or as professional-quality computer file images. A photo release form must accompany any photographs where patients may be seen. Figure legends may be phrases or complete sentences, capitalized in sentence case, and end with a period:
Figure 2. Kinesthetic testing using an electronic inclinometer.

If electronic formats are not available to you, figures must be submitted as 5" x 7" camera-ready glossies and mailed to the Editorial Office. Figures should be numbered consecutively. For helpful guidelines on submitting figures online, visit Cadmus Journal Services (http://www.cadmus.com/). Lettering should be large, sharp, and clear, and abbreviations used within figures should agree with Journal style. Color photographs are encouraged but must be of excellent resolution and good contrast.

- Legends to Figures. Type all legends on one page after the reference list and tables.

- Tables should be formatted in Word and placed together at the end of the manuscript, after the references. Tables should be numbered consecutively. Refer to recent issues for acceptable table formats.

3. Manuscripts are only accepted electronically. **Save your monograph in Microsoft Word or plain text format.** If figures cannot be sent electronically then prepare the content of any original photographs and artwork for shipment. Include a cover letter indicating author and title of the paper the photographs or artwork are to be used for. Send to:

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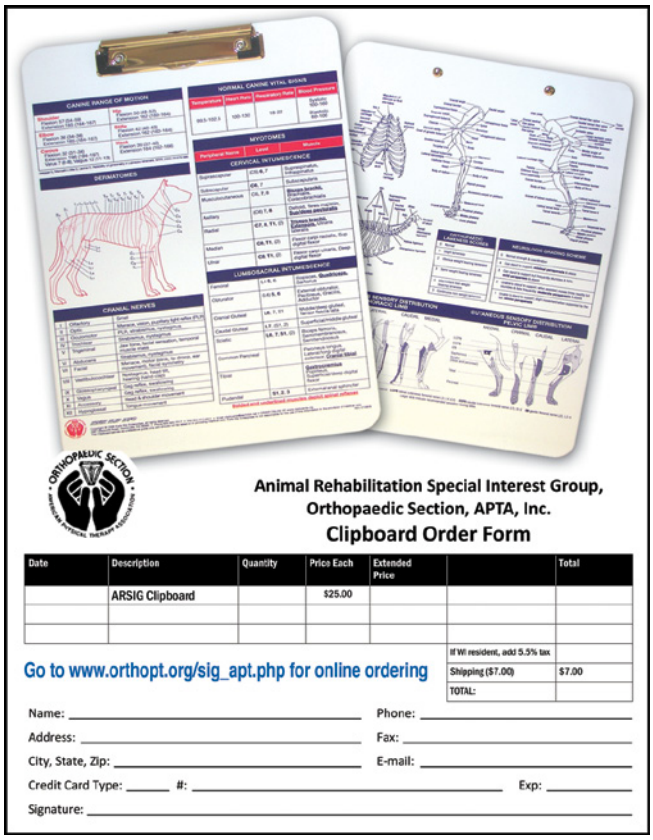

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